THE 2006 POTOMAC GORGE BIOBLITZ

Overview and Results of a 30-hour Rapid Biological Survey

Arthur V. Evans
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1600 Nottoway Avenue
Richmond, Virginia 23227

With contributions by:

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ABSTRACT

The Potomac Gorge BioBlitz, held 23-25 June 2006, was a joint venture between the National Park Service and The Nature Conservancy. It was a 30-hour intensive survey designed to document undersurveyed organisms (algae, slime molds, fungi, bryophytes, selected flowering plants, mollusks, arachnids, and insects) at sites along the Potomac River administered by the George Washington Memorial Parkway in Virginia, and the Chesapeake & Ohio Canal National Historical Park in Maryland. Eighteen taxonomic survey teams consisting of 140 volunteer scientists, naturalists, and students donated a total of 2,322 hours before, during, and after the event to observe, collect, prepare, and identify 1,232 species of algae, fungi, plants, and animals. Detailed information on the preparation, execution, and wrap-up for all aspects of the event are presented, including volunteer recruitment, public and press relations, base camp preparations, survey techniques, and data and voucher disposition.

Key words: George Washington Memorial Parkway, Chesapeake & Ohio Canal National Historical Park, Virginia, Maryland, fungi, algae, vascular plants, bryophytes, reptiles, amphibians, snails, arthropods.

INTRODUCTION

The Nature Conservancy (TNC) and the National Park Service (NPS) launched a collaborative Potomac Gorge conservation partnership in 1996, when the two groups became co-owners of a 90-acre island in the heart of the Gorge. In 2000, the two entities jointly created a comprehensive conservation plan for the area (Allen & Flack, 2001). The Potomac Gorge conservation plan identifies the Gorge's important natural resources and analyzes their greatest threats, most notably invasive plants, overabundance of White-tailed Deer (*Odocoileus virginianus* [Boddaert]), park infrastructure and recreational use pressures, and surrounding land use and development. The plan also identified significant gaps in knowledge of the biota of the Potomac Gorge, particularly for invertebrates and non-vascular plants. The Potomac Gorge BioBlitz, held 23-25 June 2006, was a direct outgrowth of this plan and designed specifically to gather information on these taxa.

The Potomac Gorge BioBlitz was the third such event to be held in the National Capital Region and followed the 1996 BioBlitz in the Kenilworth Park and Aquatic Gardens National Park on the Anacostia River, District of Columbia (USGS, 1997), as well as the 1998 BioBlitz in the Chesapeake & Ohio Canal National Historical Park, which focused on the Chain Bridge Flats area along the north bank of the Potomac River in the District of Columbia and Maryland.

The Maryland and Virginia Natural Heritage Programs and the National Park Service had extensive survey data for vascular plants and vertebrates for the Potomac Gorge parklands, but data on fungi, algae, and most invertebrate groups were lacking, which is typical of most parklands across the United States. According to Kellert (1993), invertebrates make up over 90% of the world's estimated 10 million-plus animal species, but they are among the least well-studied and

[1]DISCLAIMER: The views and conclusions contained in this document are those of the BioBlitz Coordinator and contributors and should not be interpreted as representing the opinions or policies of the U.S. Government. Mention of trade names or commercial products does not constitute an endorsement by the U.S. Government.

comprehensively inventoried taxonomic groups.

Whether invertebrates are measured in terms of diversity, biomass, or ecological dominance, these species comprise a key component of all terrestrial ecosystems and therefore must be considered in conservation planning and natural resource management (Fisher, 1998). Invertebrate inventories can provide a tremendous amount of information about natural systems. From a biogeographic and conservation perspective, studies of insect diversity can provide valuable insight into faunal patterns, community ecology, and ecosystem integrity (Collins & Thomas, 1991). Invertebrates can serve as indicators of the biodiversity in an area because of their high species diversity, their fine-grained response to environmental conditions, and their short-term response to environmental change (Longino, 1994).

Studies suggesting that species diversity enhances the productivity and stability of ecosystems (Johnson et al., 1996) underscore the importance of understanding and subsequently conserving the full range of diversity in natural areas. Essential ecosystem services provided by bacteria, fungi, and invertebrates help to generate soil and maintain its fertility, dispose of wastes and recycle nutrients, pollinate crops, and control pests that eat them (Ehrlich, 1987).

Sampling invertebrates poses problems due to high species diversity, with estimates ranging from six to 80 million species worldwide for insects alone (Hawksworth & Mound, 1991). The vast majority of natural areas remain undersurveyed for invertebrate groups. Coddington et al. (1991) suggested that species sampling methods should be fast, reliable, simple, and inexpensive. Their recommendations reflect the urgency felt in many areas where species are being lost faster than they can be catalogued, as well as the resource limitations often faced by both scientists and resource managers. Although collecting this important information can be overwhelming, Landau et al. (1999) demonstrated that a considerable proportion of the invertebrate diversity in an area can be inventoried during a short, intensive sampling survey, such as a BioBlitz. BioBlitzes bring together a diversity of experts devoted to conducting an intensive survey in a very short period of time for a relatively small investment in resources.

BioBlitzes provide only a snapshot of biodiversity and are not intended as substitutes for long-term inventory and monitoring efforts. Findings are influenced by season, lunar cycle, and weather conditions during the collection period, as well as the availability of taxonomic specialists and the experience of surveyors. Nevertheless, BioBlitzes can produce useful lists of species that may support effective natural resource management and suggest avenues for sustained research programs in the future.

Study Site

The 9,700-acre (3925.5 ha) Potomac Gorge project area (see map on inside front cover) is the 15-mile (21.4 km) river corridor from Great Falls to the Key Bridge, including parts of Maryland, Virginia, and the District of Columbia. It is in the midst of a major metropolitan region inhabited by over 4.5 million people (see Cohen, 2005). The Potomac Gorge is widely recognized as one of the most biologically rich areas in the eastern United States, with more than 400 known occurrences of 200 state or globally rare plant and animal species, and ten globally rare plant communities. The Gorge's unusual concentration of species diversity and rarity is the direct result of its unique hydrology, geology, and geomorphology. This wild and free-flowing section of the Potomac River is one of the most intact eastern Fall Zone river systems with an abundance of parkland not subject to the environmental pressures of residential or commercial development.

Approximately half of the Potomac Gorge project area is owned and managed by the George Washington Memorial Parkway and the Chesapeake & Ohio Canal National Historical Park. More than two million recreational users visit these two national parks each year. The remainder of the Gorge is a mixture of private, county, and federal land.

The Potomac Gorge BioBlitz survey teams were charged with conducting their inventory work on national park service lands administered by the George Washington Memorial Parkway (GWMP, DC, VA, and MD) and the Chesapeake & Ohio Canal National Historical Park (CHOH, MD). Specific survey sites in the GWMP included Chain Bridge Flats (DC), Great Falls Park (VA), Turkey Run Park (VA), and Glen Echo Park (MD), and those in the CHOH included Plummers Island (MD) and Great Falls Park (MD).

Planning and Logistics

The Nature Conservancy began initial planning for the Potomac Gorge BioBlitz in 2003 and sought funding through the National Park Service's Natural Resource Challenge-Natural Resource Protection Program. In the ensuing years, TNC also secured private funds and in-kind support for the BioBlitz from a variety of sources (see Acknowledgements). A few individuals also provided financial donations and in-kind support to the BioBlitz.

Dr. Arthur V. Evans was contracted by TNC to serve as the BioBlitz Coordinator. Evans had organized

two previous Virginia BioBlitzes (2002, 2003), and was thus already familiar with the logistics of recruiting, organizing, and directing taxonomic working groups consisting of team leaders, naturalists, and students. In addition to these duties, he was charged with securing the necessary collection permits (one state and two national parks), managing the species data, and preparing the final report for publication in a peer-reviewed journal. From his own resources, Evans provided the 50% funding match necessary to complete the task.

The Connecticut State Museum of Natural History's "BioBlitz Organization Guide" (Censky, 2001) provided useful information on methods and strategies that were implemented in organizing the Potomac Gorge BioBlitz. Detailed organizational planning for the BioBlitz with Evans and representatives of NPS (including staff from the CHOH, GWMP, and the National Capital Region Center for Urban Ecology) and TNC began in earnest a year before the event. This core team of BioBlitz organizers met several times and communicated regularly by phone and email to resolve various planning and data management issues leading up to the event. TNC staff coordinated the logistics for the survey weekend, including base camp organization, daily operations, participant safety, food, media relations, and public educational programming.

The initial goal of the BioBlitz Coordinator was to recruit as many skilled team leaders as possible to lead field teams to survey historically undersurveyed taxa on NPS lands in the Potomac Gorge. The recruitment of team leaders was a critical component of the Potomac Gorge BioBlitz because they were largely responsible for assembling their own teams of experts and skilled naturalists to conduct the surveys. The BioBlitz Coordinator began recruiting team leaders and survey volunteers in October of 2005. Invitations to participate in the Potomac Gorge BioBlitz were distributed through entomological web-based listserves, e-mail lists from previous Virginia BioBlitzes, and other electronic communications channels.

Specialists were sought to conduct field surveys for a broad array of undersurveyed organisms, including bacteria, algae, slime molds, fungi, and invertebrates. In total, 18 scientific team leaders were recruited to build and lead teams that would survey organisms spanning four kingdoms and as many as 25 classes/divisions of organisms. Besides teams to sample undersurveyed taxa, two additional teams participated in the Potomac Gorge BioBlitz. Members of the Virginia Herpetological Society volunteered to field a survey team for amphibians and reptiles to supplement data gathered during previous inventories. Also, a vascular plant survey team focused their efforts on selected rare plant species or species in need of verification as occurring in Great Falls Park (GWMP, VA). With guidance from NPS staff, each team leader set the survey strategy for the team, divided up responsibilities, and communicated with the team on all aspects of the survey. Team leaders then recruited members, which included research scientists, students, and amateur naturalists.

The weekend of 23-25 June was selected for the Potomac Gorge BioBlitz for a variety of reasons, including proximity to a new moon to enhance nighttime blacklight collection efforts for nocturnal insects, to follow the end of the academic year, to avoid conflicts with major holidays, and to take advantage of a peak in adult insect activity, a taxonomic group that would likely make up the majority of the species observed in the area.

One hundred forty survey volunteers (see photo on inside front cover) came from as far away as Washington state and California, but most were from the Mid-Atlantic region, representing more than 30 universities, government agencies, museums, non-profit organizations, nature centers, and schools. To support the work of the field research volunteers, TNC recruited 50 logistical support and public education volunteers who collectively donated hundreds of hours of effort before and during the survey.

The base camp for the Potomac Gorge BioBlitz was centrally located at Glen Echo Park in Maryland (part of the GWMP), which offered such amenities as restrooms, lab space (Fig. 1), and sleeping quarters. The nearby grounds provided the site for a series of public education programs and exhibits during the event.

Communications and Public Education

To facilitate communications with the BioBlitz participants, Virginia Natural History Society web-master John White designed and supported a Potomac Gorge BioBlitz website, allowing the field researchers to download maps and directions, logistical information about food, travel, and lodging, and obtain instructions related to permitting, collecting, and data recording.

A key objective of the BioBlitz was to raise public awareness of the rich natural heritage of the Potomac Gorge. Glen Echo Park was selected as a base camp for the BioBlitz in part because it is a popular destination for area residents and provided an ideal setting for the event's public educational programming. The park allowed the placement of a large tent, under which twelve educational groups provided a range of engaging activities and exhibits, including leading children's bug walks, displaying and interpreting preserved insect collections, demonstrating the life cycle of butterflies,

Fig. 1. Researchers and volunteers worked long hours to sort, prepare, and identify specimens at the base camp located at Glen Echo Park, MD.

and explaining the purpose of the BioBlitz. Since access to the base camp laboratory was restricted to BioBlitz volunteers, several field researchers took time out from their survey and identification work to spend time with the public, answering questions as they sorted specimens.

To advertise the BioBlitz and its public educational programming prior to the event, TNC developed and disseminated a news release that was posted on the Website, sent to various community listserves, and distributed through other NPS communication channels.

To create a visual identity for the BioBlitz, snail team volunteer Kim Harrell designed an engaging logo for the event that was used on a promotional poster (see back cover). The luna moth logo also appeared on the official Potomac Gorge BioBlitz t-shirt that was given to all of the volunteers who participated on the teams that conducted surveys, provided educational programming, or assisted with logistical support. A BioBlitz brochure provided a schedule of public events and educational activities over the course of the weekend. The Kratt Brothers (Fig. 2), hosts of popular nature television programs, served as emcees for the BioBlitz closing ceremony and preliminary species count announcement on the final afternoon. Unfortunately, heavy rains in the region during the weekend resulted in lower than expected participation by the public in both the educational activities and the closing ceremony.

The BioBlitz generated extensive media coverage in the competitive Washington, D.C. media market, including a radio spot and more than 10 print and online articles. The most prominent features appeared in the Sunday edition of *The Washington Post* (Williamson, 2006) and in the magazine *Science Times* (Milius, 2006). The event was also featured in the Winter 2006 issue of *Nature Conservancy* magazine (Ferber, 2006), which is sent to 600,000 member households.

Fig. 2. Television's Kratt Brothers led the closing ceremony for the 2006 Potomac Gorge BioBlitz on a rainy afternoon at Glen Echo Park, MD.

TAXONOMIC SURVEY TEAMS

Each of the 18 taxonomic survey teams employed its own set of methods for conducting surveys, locating target taxa, and collecting and interpreting data, as described below.

Green algae survey (exclusive of diatoms and cyanobacteria)

The survey team split into two groups; the first group collected along the C & O Canal (CHOH) on the Maryland side of the Potomac, while the second gathered samples along the Potomac River on the Virginia side at Great Falls Park and in puddles located in Turkey Run Park (GWMP). Samples were gathered only on 24 June; the next day was spent preparing and identifying the collections.

Additional samples were collected and submitted by the Adkins family (Jasmine, Mike, and Sebastian), DorothyBelle Poli, and Ester Stein of the bryophyte team. One sample was collected from the shell of a Northern Red-bellied Cooter (*Pseudemys rubriventris*) by the amphibian and reptile survey team and was submitted by the team leader, Jason Gibson.

Generally, whole water samples of about 50 mL were collected using sterile whirl-pacs or tubes. Care was taken not to contaminate subsequent samples or habitats with algae from previous sample sites. In some cases, a 10 µm mesh plankton net was used to collect water from larger bodies of water. All samples were labeled and placed on ice until they could be examined in the laboratory. A portion of these samples was preserved in 5% Lugol's Solution with 10% glycerol and submitted to the National Park Service as voucher material.

Samples were taken to the University of Maryland in College Park where they could be examined with light microscopes and identified. Line drawings of cells were made (Fig. 11) and digital micrographs recorded. Cells were identified from the micrographs and living or preserved cells. Conjugating green algae and dinoflagellates were identified with the aid of various references, including field guides and regional floras (Smith, 1920, 1924; Conrad & Van Meel, 1952; Taft & Taft, 1971; Whitford & Schumacher, 1984; Croasedale & Flint, 1986, 1988; Hedgewald & Silva, 1988; Dillard, 2000; Prescott et al., 1975, 1983; Wehr & Sheath, 2003).

Slime mold and fungus survey

Slime molds and fungi were carefully collected in the field, brought back to the base camp, placed on paper plates, identified, labeled, and photographed (Fig. 3). The fungi were identified both in the field and at the base camp by knowledgeable experts, including Lance Biechèle, John Ellifritz, Richard Gaines, Donna Mitchell, and William Roody. The nomenclature used follows that of Arora (1986) and Bessette et al. (1997).

Fig. 3. Labeled and identified fungi were photographed individually on paper plates at the BioBlitz. ©2006, Mark Godfrey.

Moss and liverwort survey

On 24 June, the bryophyte team split into two groups to collect grab-samples using two methods. Group A collected from 1000 to 1100 h and placed specimens directly into packets made of 8.5 x 11" folded 25 lb. cotton paper and recorded their collecting data on the outside of the field envelope, including date, collectors, section within the park, brief location description, GPS location, substrate, and other relevant observations. Samples were kept dry at room temperature in the packets prior to identification. Group B collected specimens from 1000 to 1900 h and placed them directly into 50 ml Falcon tubes and recorded sample numbers directly on the outside of each tube.

Sample numbers, along with their collecting data and other relevant observations were recorded in a notebook. Sample tubes were kept on ice packs in a cooler throughout the day while additional samples were collected. Prior to identification, all samples were kept in a refrigerator, within the original collection vials to maintain proper humidity and retard tissue decay while in storage.

Charles and Linda Davis prepared the voucher specimens collected by Group A for deposition with the NPS. Most of the species reported by Group B did not have high population numbers. As a result, species were observed and identified in the field only and no vouchers were prepared.

Identification of all samples was accomplished through extensive morphological and anatomical microscopy of the gametophytic and, if available, sporophytic generations. Species were keyed out using multiple sources (Dunham, 1916; Grout, 1928-1940; Conard, 1956; Crum, 1976, 1991; Crum & Anderson, 1981; Hicks, 1982; Ireland, 1982; Breil, 1996, 2003; Schofield, 2002; Porley & Hodgetts, 2005).

Select botanical survey

Since the vascular flora of the Potomac Gorge is relatively well known, the work of the botanical survey team was fundamentally different from that of other disciplines. Instead of conducting a comprehensive or inclusive inventory, work was targeted to specific taxa at Great Falls Park (GWMP, VA), for which an updated flora was under preparation by Brent Steury (Supervisory Biologist, GWMP, VA) and other cooperators (see Steury et al., 2008).

Before the Potomac Gorge BioBlitz, specific areas and habitats of Great Falls Park were prioritized for field inventory. Lists were assembled of vascular plant taxa that: 1) were known to occur in the region but had not been documented from the Park; 2) were reported from the Park without a voucher specimen; and 3) were documented only by historical specimens that may or may not have been collected within the present-day Park boundaries. Taxa that were likely to be identifiable, flowering, or fruiting in late June were targeted, and habitats likely to support these taxa were surveyed.

Fieldwork was conducted entirely on 24 June, from approximately 0900 to 1830 h. During this time several areas of Great Falls Park were visited for floristic inventory:

1. The Potomac River floodplain upstream from Great Falls proper and the Visitor Center.
2. Grasslands and rock outcrops adjacent to the Picnic Area, just downstream from Great Falls.
3. Low successional forests and the large swamp west of the Carriage Road and south of the south parking lot.
4. The bluffs and ridge above the Potomac River from Sandy Landing to near Difficult Run.
5. The floodplain and lower slopes of Difficult Run from Georgetown Pike to the Potomac River.

Specimens of taxa in need of documentation were collected, placed in plastic zip-loc bags, and ultimately into coolers during the course of the day. These were tentatively identified and placed into plant presses to dry on the evening of 24 June.

Identifications were later checked using several regional plant identification manuals, and vegetative specimens were compared with material in the Virginia Division of Natural Heritage herbarium. John F. Townsend (Staff Botanist, Division of Natural Heritage, Virginia Department of Conservation and Recreation, Richmond, VA) verified all species determinations. One problematic specimen was verified by Thomas F. Wieboldt, Assistant Curator of the Massey Herbarium at Virginia Tech in Blacksburg, VA. All vouchers were delivered to Brent Steury for deposition in the GWMP herbarium.

Triclad planarian survey

Since all triclad planarians are negatively phototactic, individuals were sought under cover objects such as rocks, logs, bark, fallen leaves, and in masses of aquatic vegetation. Collected individuals were placed in a small container and examined in subdued light under low magnification. Because their soft bodies require special fixation and preservation techniques for identification and storage, captured individuals were identified in the field and released at the point of capture; vouchers were not retained. Identifications were made according to external features illustrated by Norden et al. (1992).

Land snail survey

All places of concealment (logs, bark, leaf litter, rocks, etc.) were examined and then carefully returned to their original position. Soil samples were also collected for examination in the lab, where they were dried and sifted to remove plant material. The soil was then examined under low magnification for the presence of small snails.

Snails were identified in the field or returned to the lab to be examined under a microscope. In a few instances, specimens were dissected to reveal details of their internal anatomy. Identifications were based, in part, on Burch (1962) and Pilsbry (1939, 1948). Specimens were also identified by Tim Pearce with the assistance of the collections and library of the Carnegie Museum of Natural History, Pittsburgh, Pennsylvania.

Subterranean macroinvertebrate survey

The area extending for approximately one meter downstream from the point of seep or spring emergence was hand picked by sorting through submerged leaves, wood, and under rocks for the presence of subterranean macroinvertebrates. Free-roaming amphipods were captured by siphoning individuals directly into a turkey baster. A representative collection of no more than 12 crustaceans (epigean or subterranean) and aquatic spring snails was collected for identification from each site.

All specimens were immediately preserved with 70% ethanol. A field data sheet was completed for each seep or spring that included information on location (GPS), physical site description/map, water temperature, estimated flow rate, substrate composition, and other aquatic invertebrate taxa observed.

Species determinations were made using the following monographs, species descriptions, and keys: Shoemaker (1942) and Holsinger (1976, 1978) for subterranean amphipods; Holsinger (1976) for epigean amphipods; Bowman (1967) and Williams (1970) for aquatic isopods; and Hershler et al. (1990) for spring snails. Appendage removal for microscopic examination was required for many species determinations.

Crustacean survey (crayfish and copepods)

Diurnal searches for crayfishes were performed in both lentic and lotic habitats (see Table 10). Searches in headwater and second order streams involved turning over small rock slabs, boulders, and substrate debris. This technique was particularly efficient at collecting *Cambarus bartonii* from headwater streams, with the largest individuals procured from the largest available slabs. Detrital beds in thalwegs were sampled by dip nets and transferred to the stream bank to remove all captured crayfish.

Nocturnal searches were also employed to collect riverine tertiary burrowers. Casual searches were initiated at least two hours after sunset to ensure nocturnal species activity. Headlamps were used to illuminate crayfish foraging in the littoral zone of the Potomac River mainstem and associated eddies. These individuals were captured with dip nets and by hand, and transferred to collecting vessels.

Burrowing crayfish, such as *Cambarus diogenes*, were collected by excavating their burrows. Burrow activity was determined by the presence of chimneys or fresh mud pellets at burrow openings. Active burrows were excavated with trowels and shovels until an enlarged cul-de-sac or "resting chamber" was reached (Hobbs, 1981). Once the resting chamber was breached, the burrow was filled with water and then plunged with the investigator's hand and arm. This pumping action usually was sufficient to dislodge crayfish hiding deep within the confines of the burrow and draw them into the resting chamber where they were captured by hand.

If initial plunging efforts were unsuccessful in dislodging crayfish, the burrow was left undisturbed for several minutes. Crayfish curious about this disturbance would often rise to the water/air interface where their presence could be determined by waving antennae. In this situation, crayfish were quickly pinned to the sides of the burrow, carefully manipulated, and ultimately extracted. Burrow morphology data were collected on occupied burrows; data collected included central shaft depth, resting chamber width and height, and terminal burrow depth, as well as burrow contents. All burrows were measured in centimeters.

All vouchers were preserved in the field in 70% ethanol. Crayfish were identified in the laboratory using Hobbs (1972) and Jezerinac et al. (1995). Demographic data collected on all specimens included sex (Form I male, Form II male, or female) and life stage (neonate and adult). Morphometric data (see Table 11) were collected with vernier calipers and included carapace length (CPL) and palm length (PL) in millimeters.

Copepods inhabit open waters of lakes, ponds, stream eddies, and ephemeral water bodies, but by far the larger number are closely associated with different kinds of substrates, such as leaf packs in streams to muddy or sandy bottom sediments, and semiterrestrial situations such as damp soil or moss. In order to collect the widest range of species from a given area, it is best to sample in open waters and also in possible copepod-harboring substrates. During the BioBlitz, samples were

taken from the open water of Clay Pond at Great Falls Park (GWMP, VA) and the Chesapeake & Ohio Canal (CHOH, MD) with a small plankton net (mouth opening 10 cm and mesh size 100 µm). Samples of approximately 300-500 ml of wet soil, moss, and streambed sediments were placed in plastic bags. In all, 13 sites and substrates were sampled, 11 of which contained copepods.

All samples were transported on ice in a cooler to the laboratory, where the bags were stored in a refrigerator. Over the next several days, the still-living copepods were washed from the sediments into clear glass petri dishes and sorted with a micropipette, under a dissecting microscope. Sorting live samples is the most efficient way to locate the tiniest species, which are easily seen as they wiggle through the sediment. A few drops of alcohol added to the water in the dish serves to partly anesthetize the copepods, making it easy to catch them and also revealing more benthic species as they release their hold on the substrate.

Adult copepods were fixed and preserved in 70% isopropyl alcohol and identified using appropriate keys (e.g., Wilson & Yeatman, 1959). See Reid (2000) for detailed descriptions of procedures used in the taxonomic identification of copepods.

Arachnid survey

The arachnid team used both insect nets for sweeping vegetation and hand picking for capturing readily visible specimens. Other BioBlitz volunteers submitted samples from pitfall traps and/or sweeping (labeled "pooled" samples) and may have used additional collecting methods.

Vouchers were killed and stored in 70% isopropyl alcohol in patent lip vials with neoprene stoppers. Site labels were provided during the event; additional labels were printed. Each specimen was labeled with site, date, collector (if known), genus or species (spiders only), and determiner. Four orders of arachnids were collected, including Araneae (spiders), Acari (mites), Pseudoscorpiones (pseudoscorpions), and Opiliones (harvestmen). However, only spiders were identified to family, genus, and species levels.

Spiders were identified using several general resources and many monographs (e.g., Chamberlin & Ivie, 1941; Levi, 1956; Exline & Levi, 1962; Brady, 1964; Reiskind, 1969; Berman & Levi, 1971; Dondale & Redner, 1978, 1990; Kaston, 1978, 1981; Griswold, 1987; Dondale et al., 2003; Edwards, 2004; Richman & Vetter, 2004; Ubick et al., 2005). The current taxonomy for spider names was gleaned from Platnick (2007).

Fig. 4. Cast skins (exuviae) of dragonflies and damselflies were collected on rocks and vegetation along the shoreline of the Potomac River. ©2006, Richard Orr.

Dragonfly and damselfly survey

Adult dragonflies and damselflies were identified either through observations in the field or from collected specimens. Vouchers were prepared by placing living specimens in acetone for 24 hours. They were then dried and placed into clear envelopes with the associated data. Cast skins (exuviae) were collected on rocks and vegetation along the shores of rivers and streams (Fig. 4) and were dried, pinned, and labeled.

Mayfly, stonefly, caddisfly, and neuropteroid survey

Various methods were used to sample sites along the Potomac River, including dipnetting and visual searching of rocks, sticks, etc. in the bottom of small streams for the immature stages. All light trap collections were carefully examined for pertinent specimens. Immatures were preserved in alcohol and have not yet been identified. Adults from the light traps were either kept dry and pinned, or preserved in alcohol.

True bug survey

Most of the true bugs were collected either by a general sweep net or with a specialized shallow beating net and beating stick. The former is best for very general sampling, especially of old-field habitats and other disturbed areas. However, beating is the preferred method of collecting when attempting to determine host plants and is particularly useful for collecting species of plant bugs (Miridae). Additional specimens were taken

at UV light or in Malaise traps, both of which resulted in the collection of taxa not encountered by either beating or sweeping.

Collected specimens were pooled and returned to the National Museum of Natural History for mounting, labeling, and identification. All specimens were determined to species by Thomas Henry with the aid of the museum's reference collection and library.

Scorpionfly survey

Scorpionflies were collected with sweep nets. Specimens were initially placed into ethanol and later pinned and labeled. Field identifications were made using microscopes available at the BioBlitz. Confirmation of identifications was made later in the laboratory, using a Leica MZ6 dissecting microscope at magnifications of 6.3-400x and the key to the Nearctic species of *Bittacus* (Carpenter, 1931).

Beetle survey

The beetle team employed a variety of techniques to collect or attract as many species as possible within the limited time available for the survey. Of paramount importance was nighttime light trapping. Two 12-volt blacklight bucket traps (Fig. 5) were used, as well as a 175-watt mercury vapor light (Fig. 6) mounted on a camera tripod, to attract nocturnal species.

Pitfall traps baited with rotting meat (shrimp, chicken, fish), feces, or a mixture of fermenting molasses, banana peels, and yeast were also deployed. Funnel traps baited with a mixture of rotting bananas, beer, and yeast were hung at eye-level in tree branches.

Both diurnal and nocturnal inspections of various species of plants and their structures, including flowers, fruits, cones, branches, leaves, and needles were undertaken. Dead trees, logs, and stumps, especially those still covered with loose bark, and their associated

Fig. 5 (left). A 12-volt blacklight bucket trap for collecting nocturnal insects. ©2006, Roy Sewall.
Fig. 6 (right). A 175-watt mercury vapor light set up for collecting nocturnal insects. ©2006, Roy Sewall.

Fig. 7. Using a beating sheet at night with the aid of a headlamp to collect beetles. ©2006, Roy Sewall.

fungi, were carefully inspected. Free-living fungi, mosses, and lichens were also examined with a hand lens to locate adult beetles.

Vegetation was sampled, day and night, with the aid of a beating sheet (Fig. 7). Beetles beaten from vegetation were collected from the sheet either by hand or sucked into an aspirator.

Team members also searched beneath stones, logs, and other objects on the ground, especially in moist habitats along the edges of streams. Ponds, pools, streams, and other aquatic habitats were not surveyed for water beetles, although aquatic species were collected at lights at night.

All live specimens were transferred to killing jars charged with ethyl acetate or potassium cyanide, or placed in vials partially filled with 70% isopropyl. All specimens from each locality were then placed in separate white plates or plastic sorting trays and segregated by morphospecies. Typically, no more than six individuals of each morphospecies collected from each of the three parks (CHOH, GRFA, TRRU) were mounted (pinned or pointed) and labeled (Fig. 8).

Specimen labels included country, state, county, park, specific locality, latitude and longitude (if available), date, collector, and method of collection (if known). All specimens bear determination labels indicating genus, species (if known), authority, determiner, and year of determination. The determination labels on all specimens collected in Virginia bear labels with the line "Virginia Beetle Project." These specimens have been entered into a separate database maintained by A.V. Evans as part of a statewide beetle survey.

A.V. Evans, S. Lingafelter, D.L. Meade, J. Prena, W.E. Steiner, and N.E. Woodley identified vouchers to family, genus, or species. Resources for identifications included, in part, the two-volume *American Beetles* (Arnett & Thomas, 2001; Arnett et al., 2002) and many of the publications cited therein. Larger works of particular use were those of Ciegler (2000, 2003), Dillon & Dillon (1972), Downey & Arnett, (1996), Harpootlian (2001), Staines (2006), and Yanega (1996). Vouchers were also identified through comparison with specimens housed in the private collection of A.V. Evans in Richmond, Virginia, and the entomological collections of the National Museum of Natural History (NMNH), Washington, DC.

Fly survey

Nearly all flies were collected with aerial nets. The severe weather precluded use of additional collecting techniques. Smaller specimens were double mounted on minutens or glued to paper triangles, whereas larger specimens were directly pinned. All specimens were labeled with specific locality, date, and collector information. In most cases, geographic coordinates supplemented locality data. Prepared specimens were identified to family and sent to specialists for more specific determinations. Specimens of a few families were identified to morphospecies only.

Moth and butterfly survey

The fauna of the area was sampled using blacklight traps on the evenings of 23 June and 24 June. Traps were deployed at several sites, including Bear Island (J. Lewis), Carderock (D. & M. Davis), and Plummers Island (J. Brown & K. Vann) (CHOH, MD). Another black light trap was set in the GWMP, VA at Turkey Run (J. Brown & K. Vann). Additional specimens were procured from light traps operated at Great Falls Park (GWMP, VA) by the beetle survey team. Two diurnal surveys conducted on Plummers Island on 24 June provided observations of several butterfly species. The vast majority of the species and specimens were collected in the traps at night.

Ant and bee survey

Bees were collected using insect nets and a series of fluorescent yellow, fluorescent blue, and white 3.25 ounce "bee bowls." Bowls filled with water and a small amount of detergent were set on the ground. They were collected at the end of the day, and specimens were rinsed with water and transferred to alcohol. Bee vouchers were identified by Sam Droege, who consulted with Discoverlife online identification guides (www.discoverlife.org), Mitchell (1960, 1962), and an unpublished list of state bee records compiled by John Ascher. Wasps inadvertently collected during the

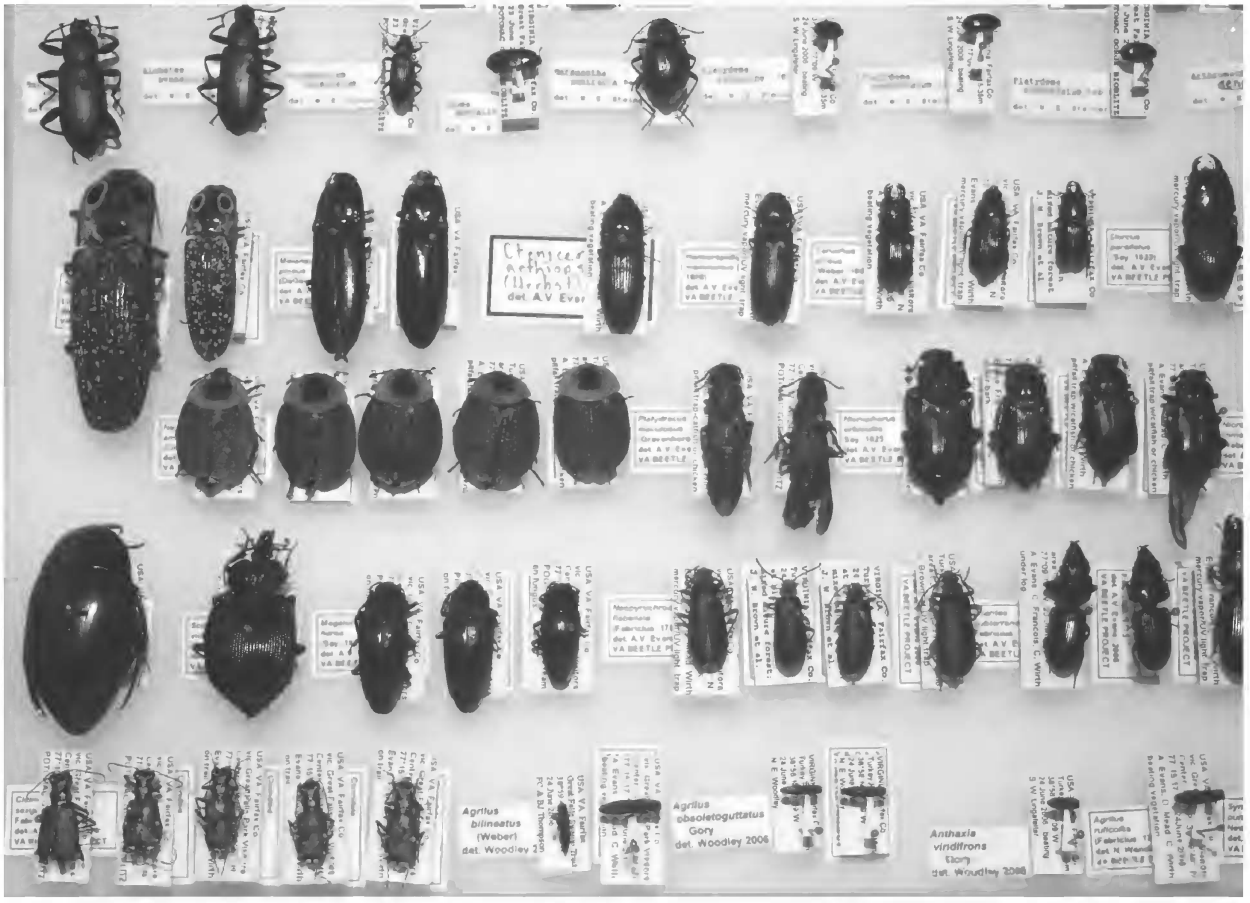

Fig. 8. A portion of the prepared, labeled, and identified beetle vouchers collected during the BioBlitz. The mandatory deposition of all vouchers in NPS facilities discouraged some scientists and their institutions from taking part in the Potomac Gorge BioBlitz. ©2006, Arthur V. Evans.

survey were not identified and are not included in the final species tally..

Ants were collected by various methods, pinned, and identified by Daniel Kjar who compared them with the collections of the National Museum of Natural History, Smithsonian Institution, and the entomological collections housed at Georgetown University.

Amphibian and reptile survey

Animals were collected by hand capture, dipnetting, visual encounter, overturning cover objects, digging through trash piles, and listening for calling anurans. Hoop turtle traps (Fig. 9) were deployed on 23 June in Great Falls Park (GWMP, VA), four in Clay Pond and three along the Potomac River. Each trap was baited with one can of water-packed sardines. In a concerted effort to prevent the possible spread of disease, traps and other collecting equipment were disinfected with bleach before moving from one wetland to another.

All captured animals were briefly examined for evidence of disease or parasites (Fig. 10). Digital photos were taken for vouchering purposes. At least two knowledgeable members of the group had to agree on the identification of each animal before it was released back into the wild. Paul Sattler or Jason Gibson recorded all observations.

Recording data

Initial observations and collection data for some voucher specimens were entered into computers supplied with a Microsoft Excel spreadsheet that included park code (CHOH, GLEC, GRFA, or TRRU), site, location, date, latitude, longitude, habitat, family, species, determiner, abundance, native?, #vouchers, #observed, collector(s)/observer(s), and comments. All data and voucher specimens from the GWMP were submitted to Brent Steury (Supervisory Biologist,

Fig. 9. Hoop turtle traps were deployed in Clay Pond and the Potomac River. ©2006, Roy Sewall.

Fig. 10. Captured amphibians and reptiles were inspected for signs of disease or parasitic infection before their release. ©2006, Roy Sewall.

Natural Resources Program Manager, George Washington Memorial Parkway, Park Headquarters, Turkey Run Park, McLean, VA 22101). Sam Tamburro (Park Historian, Chesapeake & Ohio Canal National Historical Park, 1850 Dual Highway, Suite 100 Hagerstown, MD 21740) received data and specimens collected in the CHOH. These data were also sent to Geoffrey Sanders (Data Manager, National Capital Region, Center for Urban Ecology, 4598 MacArthur Blvd., NW, Washington, DC 20007).

During the summer of 2007, Anna Santos (now with the MD/DC chapter of TNC) was hired as an intern by the NPS to accession and digitally catalog all Potomac Gorge BioBlitz specimens for both the GWMP (housed at Turkey Run Park) and CHOH (housed at the NPS Museum Resource Center). This project revealed many inconsistencies between the voucher specimens, species data sheets, and tallies that appeared in an early draft of the survey report. These discrepancies were resolved through close cooperation between Santos, Evans, and the team leaders (see Santos, 2007).

SURVEY RESULTS

Survey team leaders submitted summaries of their inventories, providing some or all of the following information, if pertinent to their survey:

1. A brief summary of previous surveys for the taxonomic group(s) in the region based on published scientific literature and unpublished reports filed with the NPS.

2. A description of methods and materials used to observe individuals, or to collect and prepare specimens (see previous section).

3. A list of the resources (museum and university collections, monographs, etc.) used for the identification of vouchers.

4. Comments on noteworthy species, especially, new state or park records, verification of historic records, species new to science, global or state rare (G1/S1) species, etc.

5. Comments on exotic or introduced species.

6. Offer personal impressions of the survey results, including effects of field conditions and seasonality on diversity, expected taxa vs. observed taxa, suggestions for maximizing the efforts of future surveys, suggested locales on NPS lands for future survey work, and conservation concerns, if any, and suggested remedies.

7. A complete list of team members and estimates of combined total hours spent by the team in the field (including travel time) and number of hours dedicated to specimen preparation and identification (including data entry, report writing, and specimen transfer to the NPS).

Green algae
(exclusive of diatoms and cyanobacteria)

John D. Hall, Department of Cell Biology and Molecular Genetics, University of Maryland, 2106 HJ Patterson Hall, College Park, MD 20742; jdhall@umd.edu

Susan Carty, Department of Biology, Heidelberg College, 310 E. Market Street, Tiffin, OH 44883; scarty@heidelberg.edu

No previous studies of the algae have been undertaken in the parks of the Potomac Gorge. During the BioBlitz, the algae team set out to document the algal flora of Great Falls and Turkey Run Parks (GWMP, VA) and portions of the CHOH, MD. The results were compared with a checklist of the known algal flora of the surrounding region in Virginia and Maryland compiled from various sources (Transaeu, 1950; Forest, 1954; Woodson, 1959, 1969; Woodson et al., 1966; Woodson & Gore, 1968; Woodson & Wilson, 1973; Nemeth, 1969; Marshall, 1976, 2001; Woodson & Afzel, 1976; Woodson & Seaburg, 1983; Parson & Parker, 1989; Sheavly & Marshall, 1989; Marshall & Burchardt, 2004). With the exception of a few small groups, the checklist of Maryland freshwater algae was quite incomplete; the Virginia flora is much better known.

Although freshwater algae are ubiquitous, they are highly sensitive to environmental changes, especially those affecting the characteristics of the medium in which they live. As a result, algal communities are known to change over the course of a single season and over the years in response to both naturally occurring phenomena and anthropogenic disturbances. Therefore, the results of the BioBlitz represent only a snapshot of just a portion of the algae flora of the Potomac Gorge. Much more work is needed to better understand the true diversity of the region.

The survey areas have a number of interesting, if not unique, habitats where one may encounter freshwater algae. When not flooded, the Potomac River has a large floodplain north of Great Falls where the river is wide and interrupted by small islands and large rocks that emerge from the water. These islands and rocks often contain small pools filled by rain or receding floodwaters that usually dry up annually. Along the Potomac's shores are a number of eddies and backwaters where large blooms of algae were frequently encountered. These were mostly cyanobacteria, but sometimes chlorophytes such as *Cladophora* and *Hydrodictyon reticulatum*, were present.

A list of the 32 sample locations is presented in Table 1 that includes some of the waters of the Potomac and its tributaries that are diverted into the C & O Canal. Sections of the canal that have fallen into disrepair contain stagnant collections of rainwater, creating a series of artificial tanks harboring algae that remain isolated from the Potomac's seasonal floodwaters.

Besides the river and the canal, there are two additional large bodies of water in the parks that were examined. Clay Pond, in Great Falls Park (GWMP, VA), is a shallow water body that is mostly shaded by large trees and is covered in *Lemna* and *Wolffia* that allows very little light to penetrate the pond. Rodey Pond (CHOH, MD) was also sampled, along with several smaller water bodies on both sides of the Gorge, including seeps, rain puddles, and damp soils. Algae from all of these habitats were collected and identified.

Figure 11 illustrates the algae species encountered during the BioBlitz; of the 68 taxa documented, several were recorded for the first time in the region. We had hoped to report on the conjugating green algae and dinoflagellates of the park (the areas of expertise of the authors), but few of these taxa were encountered during the inventory. It was not possible to identify all algae found during the survey.

The samples discussed below are of special note or were unidentifiable to species due to the lack of reproductive structures. Most of these entries include a brief description followed by an estimate of size based on the length (L.) along the longest axis and width (W.) of the shortest axis. In species where the cell is cylindrical or spherical, the width (W.) refers to the diameter of the organism. The sample numbers refer to vouchered field samples (see Table 1 for localities) deposited in the collections of the NPS.

Phylum Charophyta

Cosmarium sp. 1
(samples PGA2006.06.24-18, 20, 22; Fig. 11 [20]).

Semicells trapeziform, margins crenate; apical margin with five small verrucae; cell surface protruding in midregion in apical view. Too few cells were observed to identify to species, but the observed features are somewhat inconsistent with species of *Cosmarium* known from North America. L. 25-27 µm x. W. 18-23 µm, 13 µm thick in apical view.

Mougeotia sp.
(samples: PGA2006.06.24-15; PGB2006.06.24-9,10)

Several species are present in the park, but it was not possible to identify them without reproductive structures.

Table 1. Algae samples collected during the 2006 Potomac Gorge Bioblitz, 23-25 June 2006.

PARK[1]	LOCATION	SAMPLES
GF	Clay Pond	PGA2006.06.24-1, 2, 3
GF	Pool along Potomac River	PGA2006.06.24-4, 5, 6, 7, 10, 12
GF	Potomac River	PGA2006.06.24-8, 9
GF	Pothole in rocks in Potomac River	PGA2006.06.24-11, 13
GF	Along road near Potomac River	PGA2006.06.24-14, 15
GF	From old canal near viewing area	PGA2006.06.24-16
GF	Wet spot on concrete at visitors center	PGA2006.06.24-17
TR	Puddle at Turkey Run	PGA2006.06.24-18, 19, 20, 21, 22
CHOH	Canal at Lock 10	PGB2006.06.24-1, 2
CHOH	Potomac River at Lock 10	PGB2006.06.24-3, 4
CHOH	Canal at Lock 8	PGB2006.06.24-5
CHOH	Canal at Lock 7	PGB2006.06.24-6, 7, 8
CHOH	Rodey Pond	PGB2006.06.24-9, 10
CHOH	From carapace of N. Red-bellied Cooter	PGD2006.06.25-1

[1]George Washington Memorial Parkway, VA (GF=Great Falls Park; TR=Turkey Run Park); CHOH=C & O Canal National Historical Park, MD.

Sirogonium sp.
(samples: PGB2006.06.24-9, 10)

A single species of this genus was observed. It was not possible to identify it without reproductive characters.

Spirogyra sp.
(samples: PGA2006.06.24-10, 15; PGB2006.06.24-10)

Several species are present in the park, but it was not possible to identify them beyond genus without reproductive structures.

Zygnema sp. (samples: PGA2006.06.24-3, 18, 19, 20)

Several species are present in the park, but it was not possible to identify them beyond genus without reproductive structures.

Phylum Chlorophyta

Basicladia chelonum (Collins) Hoffman
(sample PGD2006.06.25-1; Fig. 11 [24])

W. ca. 27 µm, length variable. Collected from the carapace of a Northern Red-bellied Cooter (*Pseudemys rubriventris*) captured at CHOH, MD. The *Basicladia* sp. previously recorded from Virginia (Forest, 1954) was very likely *B. chelonum*.

Chlamydomonas sp. (samples: PGA2006.06.24-13, 22; PGB2006.06.24-2, 5; Fig. 11 [29]).

Too few cells were observed to identify with confidence to species. L. 16 µm x W. 11 µm.

Oedogonium sp. (samples: PGA2006.06.24-13, 15; PGB2006.06.24-9, 10)

Several species are present in the park, but it was not possible to identify them to species without reproductive structures.

Scenedesmus brasiliense Bohlin forma
(sample: PGB2006.06.24-6; Fig. 11 [13])

Similar to the typical form (Fig. 11 [12]) except that the cells, particularly those near the ends of the cenobium have two ridges along the length of the cell on each side (four on each cell). These ridges seem to be produced at the apices into what would appear to be spines. It is very likely that this form has been described as a separate subspecies or variety from another location; further research is needed to clarify its identity. L. 13 µm x W. 5 µm.

Phylum Chrysophyceae

Lagynion scherffelii Pascher
(sample: PGB2006.06.24-2; Fig. 11 [51])

Living cells were not observed; this is a possible dubious identification and it may be *L. ampullaceum*, but the observed cells seemed less spherical than is typical for that species. L. 6-8 µm x W. 3-4 µm. Not reported from Virginia.

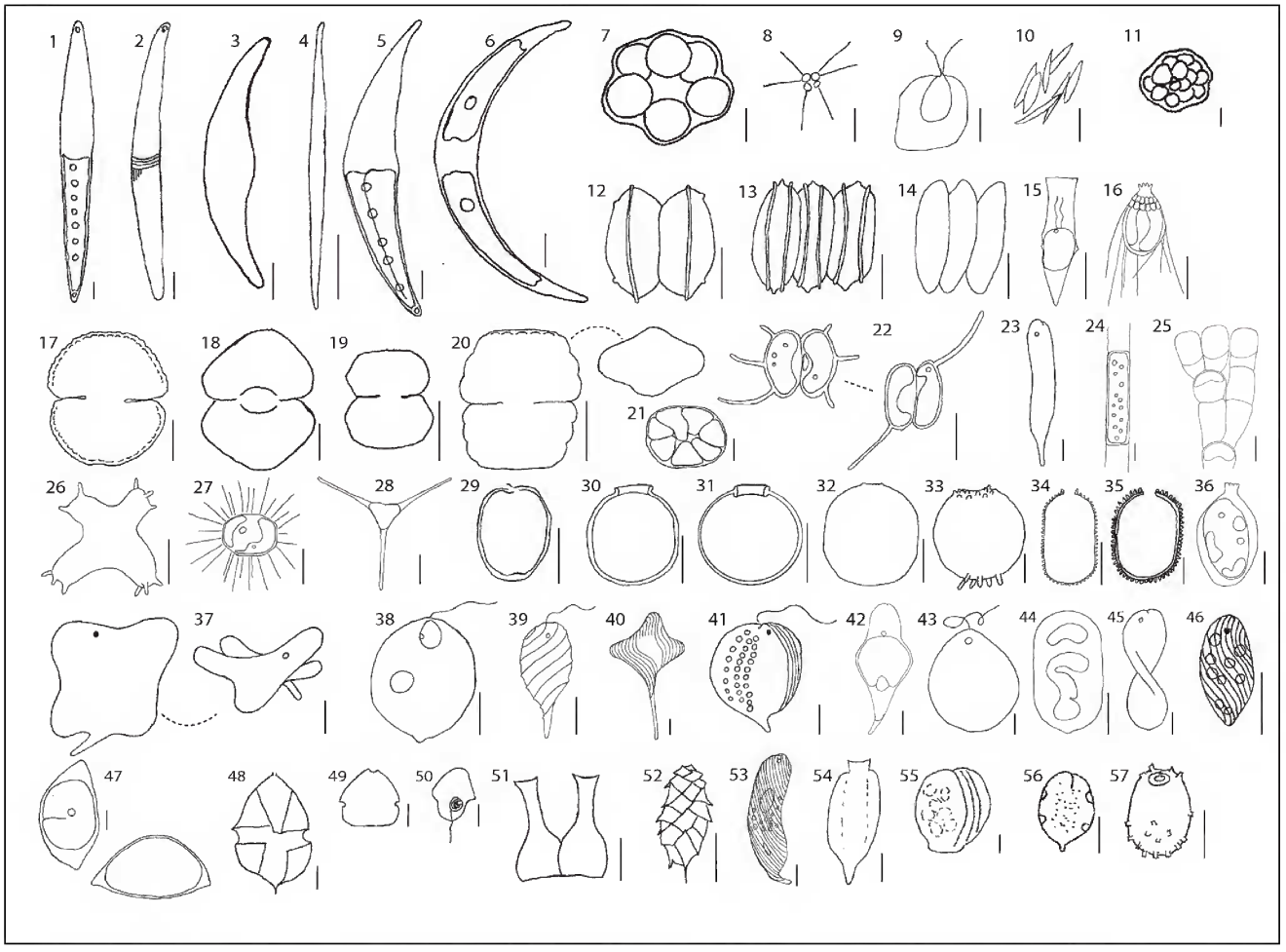

Fig. 11. Green algae collected during the 2006 Potomac Gorge BioBlitz, 23-25 June 2006. Scalebar length is 10 µm for each species unless noted otherwise. 1. *Closterium acerosum* (Schrank) Ehrenberg, scalebar = 50 µm; 2. *C. striolatum* Ehrenberg ex Ralfs, scalebar = 50 µm; 3. *C. ehrenbergii* Meneghini, scalebar = 50 µm; 4. *C. macilentum* Brébisson, scalebar = 50 µm; 5. *C. lunula* (Müller) Nitsch, scalebar = 20 µm; 6. C. cf. *venus* Kützing; 7. *C. microporum* Nägeli, scalebar = 5 µm; 8. *Micractinium pusillum* Fresenius; 9. *Pteromonas angulosa* (Carter) Lemmermann; 10. *Quadrigula lacustris* (Chodat) G.M. Smith; 11. *Botyrococcus braunii* Kützing; 12. *Scenedesmus brasiliense* Bohlin, scalebar = 5 µm; 13. *S. brasiliense* Bohlin forma, scalebar = 5 µm; 14. *S. bijuga* (Turpin) Lagerheim, scalebar = 5 µm; 15. *Dinobryon divergens* Imhof; 16. *Mallomonas* sp. 1; 17. *Cosmarium obtustatum* Schmidle, scalebar = 20 µm; 18. *C. granatum* var. *granatum* Brébisson ex Ralfs; 19. *C. abbreviatum* Raciborski; 20. *Cosmarium* sp. 1; 21. *Pandorina morum* (Müller) Bory; 22. *Scenedesmus abundans* (Kirchner) Chodat, scalebar = 5 µm; 23. *Euglena acus* Ehrenberg; 24. *Basicladia chelonum* (Collins) Hoffman, scalebar = 20 µm; 25. *Gongrosira burmanica* Skuja, scalebar = 20 µm; 26. *Tetraedron planctonicum* G. M. Smith; 27. *Franceia ovalis* (Francé) Lemmermann; 28. *Treubaria setigera* (Archer) G. M. Smith; 29. *Chlamydomonas* sp.; 30. *Trachelomonas oblonga* var. *australica* Playfair, scalebar = 5 µm; 31. *T. volvocina* Ehrenberg; 32. *T. zorensis* Deflandre; 33. *T. armata* (Ehrenberg) Stein; 34. *T. australica* var. *rectangularis* Deflandre; 35. *T. hispida* (Perty) Stein; 36. *T. hispida* var. *coronata*; 37. *Phacus* sp. 1; 38. *P. platalea* Drezepolski; 39. *Lepocinclis acuta* Prescott; 40. *Phacus* cf. *circumflexus* Pochman; 41. *P. pleuronectes* (Müller) Dujardin; 42. *Euglena proxima* Dangeard; 43. *Lepocinclis texta* (Dujardin) Lemmermann; 44. *Lepocinclis* sp. 1; 45. *Euglena limosa* Gard., scalebar = 20 µm; 46. *Euglena* sp. 1; 47. *Cystodinium bataviense* Klebs; 48. *Peridiniopsis polonicum* (Woloszynska) Bourrelly; 49. *Peridinium inconspicuum* Lemmermann; 50. *Gymnodinium albulum* Lindemann; 51. *Lagynion scherffelii* Pascher, scalebar = 5 µm; 52. *Mallomonas pseudocoronata* Prescott; 53. *Euglena oxyuris* Schmarda, scalebar = 20 µm; 54. *Strombomonas urceolata* (Stokes) Deflandre; 55. *Phacus stoeksii* Lemmermann; 56. *Lepocinclis glabra* Drezepolski; 57. *Trachelomonas bacillifera* Playfair.

Mallomonas sp. 1
(sample: PGB2006.06.24-5; Fig. 11 [16])

Free-living cells covered in circular scales; anterior of cell with a collar formed by scales; chloroplast single saddle-shaped, parietal; edges of cell with long setae of irregular length. L. 22 µm x W. 13 µm.

Phylum Euglenophyta

Euglena sp. 1
(samples: PGA2006.06.24-18, 20; Fig. 11 [46])

Cell somewhat fusiform; posterior produced into a very short caudus, appearing as a papillum; chloroplasts discoid; surface ridged. L. 18 µm x W. 8 µm.

Lepocinclis acuta Prescott
(samples: PGB2006.06.24-1, 5; Fig. 11 [39])

Specimens from the park (CHOH, MD) are of somewhat smaller dimensions than are often reported for this species and the caudus not as long. Previously reported from Virginia (Woodson & Seaburg, 1953).

Lepocinclis sp. 1
(sample: PGA2006.06.24-1; Fig. 11 [44])

Cell bacilliform, nearly cylindrical; pellicle smooth, rigid; posterior with a very small caudal protrusion; chloroplasts large and discoid or bowl-shaped. Few cells were observed and all were in poor condition. L. 34 µm x D. 17.4 µm.

Phacus sp. 1 (sample: PGB2006.06.24-5; Fig. 11 [37])

Cells nearly rectangular in broad view; triangular compressed in apical view; edges of cell upturned; caudus short and bent. L. 38 µm x W. 38 µm; caudus 8 µm long. Similar to several described species of *Phacus*, but the outline of the cell is very rectangular and the angles upturned.

Phylum Xanthophyceae

Vaucheria sp. (sample: PGA2006.06.24-16)

Cells in long filaments; early stages of reproductive structures present. It was impossible to identify this to species from the available material.

Cosmarium abbreviatum, *Spirogyra* cf. *jugalis*, *Gongrosira burmanica*, *Euglena limosa*, *Trachelomonas oblongum* var. *australica*, and *Cystodinium bataviense* are all thought to be new records for the state of Virginia.

Discussion. In addition to the organisms that could not be identified with great certainty as a result of the unavailability of relevant literature or the lack of reproductive structures, it appears that one of the taxa collected may be new to science. *Cosmarium* sp. 1 is inconsistent with any of the species in that genus known to the members of the survey team. Since too few cells were available, additional sampling is needed to obtain adequate material for further study to assess if this is a new species or a species known from some other part of the world.

It is less likely that the other unidentified species (*Mallomonas* sp. 1, *Phacus* sp. 1, and *Euglena* sp. 1) collected during the BioBlitz are new to science, but more investigation of these taxa is also warranted.

The conjugating green algae encountered are mostly common, widely distributed species. Of the two taxa not previously recorded from Virginia, *Cosmarium abbreviatum* is within its known range, while *Sirogonium* sp. is commonly confused with other common taxa. Because of the short duration of the survey during the BioBlitz, it is very likely that there are a great many more species of algae present in the Potomac Gorge. It would be desirable to sample the region earlier in the year when it would be possible to find more conjugating green algae in reproductive stages, and again later in the season when other species may appear.

The algae of the Potomac Gorge parks are still very poorly understood and much could be gained from a long-term study of groups in the region, including diatoms and cyanobacteria. Diatoms are of particular interest because they are valuable indicators of water quality.

The Potomac Gorge, while unique, is hardly isolated. Floodwaters regularly flow through it via the Potomac River and the Chesapeake & Ohio Canal. Furthermore, these waters are part of a major flyway for migratory birds, which are well known agents of algal dispersal. And thousands of visitors from all over the world also visit the region annually. As such, the national parklands within this region are uniquely suited for studies investigating the impacts of exotic introductions and human activity on the native flora.

A total of 68 species of green algae was recorded during the BioBlitz (Table 2). None of the species encountered are listed as threatened, endangered, or globally or state rare.

The members of the algae survey team were John Hall (team leader), Susan Carty, Gregg Mendez, Kate Nisselson, Terry Richards, Michael Rhodin, and Michael Wittig. They contributed a combined total of 60 hours in the field (including travel time and processing 32 samples), and 110 hours on specimen identification (including data entry, report writing, and specimen transfer to NPS) for a grand total of 170 hours (Table 25).

Table 2. Green algae (Kingdom Protista) documented during the Potomac Gorge BioBlitz, 23-25 June 2006. GWMP=George Washington Memorial Parkway, VA (GF=Great Falls Park; TR=Turkey Run Park); CHOH=C & O Canal National Historical Park, MD. All are new records for the Potomac Gorge. New state records for VA or MD are indicated in bold.

PHYLUM	SPECIES	GWMP		CHOH	Published VA records?[a]
		GF	TR		
Charophyta	*Closterium acerosum* (Schrank) Ehrenberg	X			7,14
	Closterium ehrenbergii Meneghini			X	2,7,13,14,16
	Closterium lunula (Müller) Nitzsch	X			Yes
	Closterium macilentum Brébisson			X	Yes
	Closterium striolatum Ehrenberg ex Ralfs	X		X	Yes
	Closterium cf. *venus* Kützing			X	Yes
	Cosmarium abbreviatum Raciborski		**X**		No (10)
	Cosmarium granatum var. *granatum* Brébisson ex Ralfs			X	17
	Cosmarium obtusatum Schmidle		X	X	7,15,18
	Cosmarium sp. 1		X		-
	Cylindrocystis brebissonii de Bary	X			1,17
	Mougeotia sp.	X		X	-
	Sirogonium sp.			X	-
	Spirogyra cf. *jugalis* (Dillwyn) Kützing	**X**		X	No (12)
	Spirogyra sp.	X		X	-
	Zygnema sp.	X	X		-
Chlorophyta	*Basicladia chelonum* (Collins) Hoffman			X	1(?) – see text
	Botyrococcus braunii Kützing			X	7,9,14,19
	Chlamydomonas sp.	X	X	X	-
	Coelastrum microporum Nägeli			X	2,9,14,15,16
	Hydrodictyon reticulatum (L.) Lagerheim	X			13
	Gongrosira burmanica Skuja	**X**			No
	Franceia ovalis (Francé) Lemmermann			X	17
	Micractinium pusillum Fresenius			X	5,7
	Oedogonium sp.	X		X	-
	Pandorina morum (Müller) Bory			X	9,13,14,15,17
	Pteromonas angulosa (Carter) Lemmermann			X	No
	Quadrigula lacustris (Chodat) G.M. Smith			X	5,9
	Rhizoclonium heiroglyphicum (Agardh) Kützing		X		13
	Scenedesmus abundans (Kirchner) Chodat			X	7,15
	Scenedesmus bijuga (Turpin) Lagerheim	X			3,5,7,8,9,14
	Scenedesmus brasiliense Bohlin			X	14,19
	Scenedesmus brasiliense Bohlin forma			X	-
	Tetraedron planctonicum G. M. Smith		X		Yes
	Tetraspora lubrica (Roth) Agardh	X			1,9,13,14,15,18
	Treubaria setigera (Archer) G. M. Smith			X	7,15
Chrysophyceae	*Dinobryon divergens* Imhof			X	2,7,9,15,18
	Lagynion scherffelii Pascher			X	No
	Mallomonas pseudocoronata Prescott			X	No
	Mallomonas sp. 1			X	-
Euglenophyta	*Euglena acus* Ehrenberg			X	3,5,7,14,15,18
	Euglena limosa Gard.		**X**		No
	Euglena oxyuris Schmarda	X		X	4,9,14
	Euglena proxima Dangeard	X	X	X	3,16
	Euglena sp. 1			X	-
	Lepocinclis acuta Prescott			X	17
	Lepocinclis glabra Drezepolski			X	No
	Lepocinclis texta (Dujardin) Lemmermann	X			1,17
	Lepocinclis sp. 1	X			-

Table 2 (continued).

PHYLUM	SPECIES	GWMP		CHOH	Published VA records?[a]
		GF	TR		
Euglenophyta	*Phacus* cf. *circumflexus* Pochmann			X	No
	Phacus platalea Drezepolski		X		No
	Phacus pleuronectes (Müller) Dujardin	X		X	9,14
	Phacus stokesii Lemmermann			X	No
	Phacus sp. 1			X	-
	Strombomonas urceolata (Stokes) Deflandre			X	No
	Trachelomonas armata (Ehrenberg) Stein		X		14
	Trachelomonas australica var. *rectangularis* Deflandre		X	X	No
	Trachelomonas bacillifera Playfair			X	No
	Trachelomonas hispida (Perty) Stein		X		3,4,5,6,9,11,15
	Trachelomonas hispida var. *coronata* Lemmermann			X	4,14,19
	Trachelomonas oblongum var. *australica* Playfair	**X**			No
	Trachelomonas volvocina Ehrenberg		X	X	4,5,11,17
	Trachelomonas zorensis Deflandre			X	No
Pyrrophyta	*Cystodinium bataviense* Klebs	**X**			No
	Gymnodinium albulum Lindemann			X	No
	Peridiniopsis polonicum (Woloszynska) Bourrelly			**X**	No
	Peridinium inconspicuum Lemmermann			X	9
Xanthophyceae	*Vaucheria* sp.	X			-

[a] Published sources: 1. Forest 1954; 2. Marshall 1976; 3. Marshall 1980; 4. Marshall 2001; 5. Marshall & Burchardt 2004; 6. Marshall et al. 1981; 7. Nemeth 1969; 8. O'Reilly & Marshall 1988; 9. Parson & Parker 1989; 10. Prescott et al. 1981; 11. Shearly & Marshall 1989; 12. Transeau 1950; 13. Woodson 1959; 14. Woodson 1969; 15. Woodson & Afzal 1976; 16. Woodson & Gore 1968; 17. Woodson & Seaburg 1983; 18. Woodson & Wilson 1973; 19. Woodson et al. 1966.

Slime molds and fungi

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Previous to the Potomac Gorge BioBlitz, numerous species of fungi have undoubtedly been found within George Washington Memorial Parkway (GWMP, VA), but they have never been formally inventoried. Mushroom hunters collecting in similar environments around the Greenbelt region of Washington, D.C. have collected as many as 200-250 species per season (J. Ellifritz, pers. comm.).

Although the BioBlitz was scheduled for 24-25 June, Biechele had an opportunity to explore Great Falls Park on the afternoon of 23 June. The remaining members of the slime molds and fungi survey team arrived early Saturday morning. The survey team concentrated its collecting efforts within Turkey Run Park (GWMP, VA). The nine-member survey team was divided into two teams. The first team, led by team leader Lance Biechele, consisted of Richard Gaines, Susan Milius, and Susanna Rhodes. The second team, led by William Roody, consisted of Nicole Cinta, Jon Ellifritz, Donna Mitchell, and Christopher Van DeMoortel. Additionally, members of other survey teams working the Maryland side of the Potomac in the C & O Canal National Historical Park contributed specimens. Of the Maryland species, only seven proved to be different from those collected in Turkey Run Park. No field collections were made during the last day of the BioBlitz due to inclement weather.

Six unknown specimens of mushrooms were collected, along with three species of unidentified rusts. Of 62 total specimens collected, 55 were positively determined to species.

The total number of specimens collected was surprisingly low. Mid-June is typically a poor time of year for many gilled mushroom species. Ideally, inventories should take place from late July through September at Great Falls and Turkey Run parks. Surveys scheduled during this time could possibly result in tripling the number of mushroom species observed and collected.

The slime molds and fungi survey team collected five species of slime molds in Great Falls Park (GWMP, VA), including *Arcyria denutata* (L.) Wettst. (Arcyriaceae), *Lycogala epidenrum* (L.) Fries (Lycogalaceae), *Fuligo septica* (L.) Wiggers (Physaraceae), *Stemonitis fusca* Roth. (Stemonitidaceae), and *Hemitrichia calyculata* (Spreg.) Farr (Trichiaceae).

Table 3. Fungi (Mycotina) documented during the Potomac Gorge BioBlitz, 23-25 June 2006. GWMP=George Washington Memorial Parkway, VA (GF=Great Falls Park; TR=Turkey Run Park); CHOH=Great Falls, C & O Canal National Historical Park, MD.

ORDER	FAMILY	SPECIES	GWMP		CHOH
			GF	TR	
Ascomycetes	Leotiaceae	*Phaeocalicium polyporaceum* (Nyl.) Tibell	X		X
	Otideaceae	*Scutellinia erinaceus* (Schwein.) Kuntze	X		
		Scutellinia scutellata (L.) Lambotte			X
	Pezizaceae	*Galiella rufa* (Schwein.) Nannf. & Korf	X		X
	Xylariaceae	*Ustulina deusta* (Fr.) Petrak	X		X
		Xylaria hypoxylon (Linnaeus: Fries) Greville		X	
		Xylaria polymorpha (Persoon: Merat.) Greville			X
Gastromycetes	Lycoperdaceae	*Lycoperdon pyriforme* Schaeff.:Pers.		X	
	Phallaceae	*Dictyophora duplicata* (Bosc.) E. Fischer		?	
	Sclerodermataceae	*Scleroderma citrinum* Pers.			X
Heterobasido-mycetes	Auriculariaceae	*Auricularia auricula* (L.) Underw.		X	
	Tremellaceae	*Calocera cornea* (Batsch) Fr.		X	
		Exidia alba (Lloyd) Burt.	X	X	
		Tremella mesenterica Retz.:Fr.		X	
		Tremellodendron pallidum (Schwein.) Burt			X
Homobasido-mycetes	Agaricaceae	*Agaricus campestris* L.		X	
	Amanitaceae	*Amanita lignophila* Atkinson		X	
	Bolbitiaceae	*Amanitopsis volvata* var. *elongata* (Peck) Lloyd		X	
		Conocybe lactea (Lange) Metrod		X	
	Boletaceae	*Boletus fraternus* Peck			X
		Boletus innixus Frost			X
	Coprinaceae	*Coprinus variegatus* Peck		X	X
	Corticiaeae	*Merulius incarnatus* Schweinitz		X	
	Crepidotaceae	*Crepidotus applanatus* (Pers.) P. Kumm.			X
	Pluteaceae	*Pluteus cervinus* (Schaeff. Fr.) P. Kumm.		X	
		Pluteus pellitus (Fr.) P. Kumm.		X	
	Polyporaceae	*Ceriporia spissa* (Schwein.:Fr.) Rajchenb.	X	X	
		Daedaleopsis confragosa (Bolton:Fries) Schroet.		X	X
		Ganoderma applanatum (Pers.) Pat.	X	X	
		Laetiporus cincinnatus (Morgan) Burds,Banik,Volk			X
		Lenzites betulina (Fr.) Fr.			X
		Phellinus gilvis (Schwein.) Pat.		X	
		Phellinus robiniae (Murrill) A. Ames			X
		Polyporus mori (Pollini:Fries) Fries		X	X
		Polyporus varius (Pers.) Fr.	X	X	
		Pycnoporus cinnabarinus (Jacq.) Fr.		X	
		Trametes elegans (Spreng.:Fr.) Fr.		X	X
		Trametes versicolor (L.) C.G. Lloyd		X	
		Trichaptum biformis (Fr.) Ryv.		X	X
		Tyromyces chioneus (Fr.) Karst.		X	X
	Russulaceae	*Russula ochrophylla* Peck			X
		Russula subfoetens Smith		X	X
		Russula vinacea Burlingham		X	
	Schizophyllaceae	*Schizophyllum commune* Fries	X		X
		Stereum complicatum (Fr.) Fries			X
		Stereum ostrea (Schwein.:Fr.) Fries		X	X
		Stereum striatum (Fr.) Fries			X
		Xylobolus frustulata (Persoon:Fries) Boidin		X	X
	Stereaceae	*Naematoloma fasciculare* (Hudson:Fr.) Karst.		X	
	Strophariaceae	*Armillariella mella* (Vahl.:Fr.) Karst.			X
	Tricholomataceae	*Lentinus strigosus* (Schwein.) Fr.		X	
		Marasmius rotula (Scop.:Fr.) Fr.	X	X	
		Megacollybia platyphylla (Pers. Fr.) Kotl. & Pouz.		X	
		Pleurotus ostreatus (Jacq.:Fr.) Quél.	X		
		Xerula megalosporia (Clements) Redhead, Ginns & Shoemaker		X	

Fifty-five species of fungi were collected (Table 3). One fungus species of particular interest was the blue bolbitus (*Bolbitus callistrus*), a rare fungus that has been collected previously at Great Falls Park; it was not found during the survey. None of the species encountered are listed as threatened, endangered, or globally or state rare.

The slime mold and fungi team spent 6.5 hours in the field, 1.5 hours on travel time, and 5 hours on specimen identification and cataloging for a total of 13 hours (Table 25).

Mosses and liverworts

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Bryophytes include the hornworts, liverworts, and mosses, and represent a poorly known division of the plant kingdom. Prior to the BioBlitz, the most recent bryophyte survey of parks within the Potomac Gorge was conducted over a five-year period by Dr. Charles Davis and Mrs. Linda Davis (Davis & Davis, 2006); both were members of the BioBlitz bryophyte team. They had collected extensively in Great Falls Park (GWMP, VA), identifying 29 families and 48 genera of mosses and 17 families and 20 genera of liverworts. No hornworts were found during their field surveys.

The bryophyte team sampled sites in Great Falls Park (CHOH, MD) and Turkey Run Park (GWMP, VA) including areas of disturbance, shade and high moisture, rocks, fallen trees, and at the edges of the waterways in order to locate a diversity of bryophytes during the BioBlitz. Due to the small size of individual bryophytes, the extensive terrain, and the small number of volunteers on the team, the collections made during the BioBlitz represented only a fraction of the species that are probably found in Great Falls Park (CHOH, MD). We focused on several potentially productive habitats. As with the Davis & Davis (2006) study, no hornworts were collected during the survey.

Of the 22 samples collected, 15 moss specimens and both liverwort specimens were identified to species. Four moss samples were determined to genus only, while several other samples were unidentified due to lack of sporophytic structures.

Season and environmental conditions were the largest obstacles faced by the bryophyte team. In June, most species are at the middle or end of their life cycle. High rates of herbivory on the sporophytes during this time by birds, deer, and other wildlife were also impediments to the collection and identification of bryophytes.

A better collection period for the hornworts, liverworts, and mosses, would have been in early May when the sporophytes are becoming mature and are more abundant. Water availability is also higher during this time of year, which supports healthier and more productive bryophyte populations. We were surprised not to find *Polytrichum ohioense* or *Sphagnum* sp., moss species that are known to be very common elsewhere in Maryland. Nevertheless, three collections made during the BioBlitz deserve special mention. *Haplohymenium triste*, *Drepanocladus* sp., and *Leucobryum glaucum* appear to only be established in the Maryland Great Falls Park (CHOH, MD), not the Virginia Great Falls Park (GWMP, VA), suggesting slight variation in habitat and/or pollution levels.

All identified species have a state ranking in Maryland of S5, which suggests that these species are demonstrably secure within the state. However, one species, *Anomodon minor*, is not ranked, suggesting that its presence in Maryland has not been previously reported. Globally, all species reported are demonstrably secure, though they may be quite rare in some areas, especially at the peripheries of their ranges.

The limited number of liverworts was unexpected to us because they are quite numerous on the Virginia side of the Potomac (Davis & Davis, 2006). The steep and rocky riverbanks sampled by the team are generally less hospitable to liverworts, which are normally found on marshier banks like those found on the opposite side of the river in the GWMP, VA. Liverworts vary greatly in size and habitat. The two species found were small and inconspicuous, occurring on or around other bryophytes.

In spite of their close proximity to one another, the brief survey conducted during the BioBlitz suggests that it is very likely that Great Falls Park (CHOH, MD) differs in habitat types and bryophyte species composition when compared to Great Falls Park (GWMP, VA) (Davis & Davis, 2006). Additional bryophyte surveys in this and other regions of the CHOH have been strongly encouraged and supported previously by the NPS.

The bryophyte survey team collected or observed 21 species (Table 4). The team members were DorothyBelle Poli (team leader), Michael J. Adkins, Chris Carr, Charles and Linda Davis, and A. Ester Sztein. The team contributed a combined total of 40 hours in the field (including preparation and travel time), and 200 hours on specimen preparation and identification (including data entry, report writing, specimen transfer to NPS) for a grand total of 240 hours (Table 25).

Table 4. Bryophytes (Class Bryopsida) documented during the Potomac Gorge BioBlitz, 23-25 June 2006. All species were collected or observed at Great Falls Park (CHOH, MD).

ORDER	FAMILY	SPECIES
Hypnales	Amblystegiaceae	*Amblystegium varium* (Hedw.) Lindb.
		Campylium chrysophyllum (Brid.) J. Lange
		Drepanocladus sp.
	Brachytheciaceae	*Bryoandersonia illecebra* (Hedw.) Robins
	Climaciaeceae	*Climacium americanum* Brid.
	Dicranaceae	*Dicranum* sp.
	Entodontaceae	*Entodon seductrix* (Hedw.) C. Mull.
	Hypnaceae	*Homomallium adnatum* (Hedw.) Broth
		Isopterygium pulchellum (Hedw.) Jaeg. & Sauerb.
	Leskeaceae	*Bryohaplocladium microphyllum* (Hedw.) Wat. & Iwats.
	Leucobryaceae	*Leucobryum albidium* (Brid. Ex. P.-Beauv.) Lindb.
		Leucobryum glaucum (Hedw.) Angstr.
	Mniaceae	*Mnium* sp. 1
		Mnium sp. 2
	Thuidiaceae	*Anomodon minor* (Hedw.) Furnr.
		Haplohymenium triste (Ces. Ex De Not.) Kindb.
		Thuidium allenii Aust.
		Thuidium delicatulum (Hewd.) Schimp
Jungermanniales	Cephaloziaceae	*Cephaloziella rubella* (sprice) Steph.
		Odontoschisma protratum (Sw.) Trevis.
Polytrichiales	Polytrichaceae	*Atrichum angustatum* (Brid.) Bruch & Schimp.

Select botanicals

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The Potomac Gorge has long been recognized as a site of great botanical diversity and has been intensively documented by field collections for more than a century (Ward, 1881; Hitchcock & Stanley, 1919; Hermann 1941, 1946; Shetler & Orli, 2000, 2002; Shetler et al. 2006). As of 1 June 2006, more than 900 vascular plant taxa had been documented from Great Falls Park, VA, both from historical specimens and more recent collections (Steury et al., 2008).

Forty-five specimens representing 38 vascular plant taxa were collected during the BioBlitz. These include:

22 taxa new to the Great Falls Park flora;

9 taxa previously known only from historical collections;

7 replacements for lost, photographic, or questionably identified vouchers.

Thirty-one of the represented taxa were native and seven were introduced. Two state-rare species were collected. A complete list of taxa collected is provided in Table 5.

The relatively small number of plant collections made during the BioBlitz in part reflects the condition of the Park's flora in early summer. In this region, late June typically constitutes a low ebb in the flowering and fruiting of vascular plants. By this time, the numerous spring geophytes and members of the family Cyperaceae that peak from late April to early June have evanesced or shed fruit. Likewise, late June falls before a late-summer peak of activity that includes members of several large families (e.g., Asteraceae, Poaceae) and a host of species occurring on exposed river shores. Nevertheless, for a one-day effort, the BioBlitz survey was relatively successful in adding new taxa to an already robust flora.

Most of the taxa new to Great Falls Park were known elsewhere in the Potomac Gorge, or were exotics that represent members of a weedy, dynamic flora that inhabits the fertile and constantly flood-disturbed river bottom.

The members of the botany survey team were Gary Fleming (team leader), Cristol Fleming, Diane Holsinger, and Betty Rosson. The team brought extensive field experience in the Potomac Gorge to the effort. Previous projects included a comprehensive study of plant communities and vegetation ecology on the Virginia side of the Gorge (G. Fleming), as well as inventories of rare species in Great Falls Park and

Table 5. Vascular plants (Kingdom Plantae) collected from Great Falls Park, VA during the 2006 Potomac Gorge BioBlitz. Classification system follows Cronquist (1981); species nomenclature follows Wieboldt et al. (2007).

Class	Order	Family	Species / ssp. / var.	Comments
Gymnosperma	Coniferophyta	Pinaceae	*Pinus echinata* Mill.	Replacement for voucher of uncertain identification
Liliopsida	Arales	Araceae	*Arisaema dracontium* (L.) Schott	Replacement for photographic voucher
	Cyperales	Poaceae	*Deschampsia flexuosa* (L.) Trin. var. *flexuosa*	Last collected 1879
	Cyperales	Poaceae	*Elymus macgregorii* Brooks & Campbell	New park record; see Campbell (2000)
	Cyperales	Poaceae	*Festuca arundinacea* Schreb.	New park record
	Cyperales	Poaceae	*Glyceria striata* (Lam.) A.S. Hitchc.	New park record
	Liliales	Liliaceae	*Maianthemum stellatum* (L.) Link.	Replacement for photographic voucher; state-rare
	Liliales	Liliaceae	*Uvularia sessilifolia* L.	New park record; specimen vegetative
Magnoliopsida	Aristolochiales	Aristolochiaceae	*Aristolochia serpentaria* L.	Last collected 1941; specimen vegetative
	Asterales	Asteraceae	*Eurybia schreberi* (Nees) Nees	Last collected 1915; specimen vegetative
	Asterales	Asteraceae	*Hasteola suaveolens* (L.) Pojark.	Last collected 1919; specimen vegetative; state-rare
	Capparales	Brassicaceae	*Brassica nigra* (L.) W.D. Koch	New park record
	Capparales	Brassicaceae	*Erysimum cheiranthoides* L.	New park record
	Caryophyllidae	Caryophyllaceae	*Silene latifolia* Poir.	New park record
	Celastrales	Celastraceae	*Euonymus alatus* (Thunb.) Sieb.	New park record
	Cornales	Cornaceae	*Cornus amomum* P.Mill. ssp. *obliqua* (Raf.) J.S. Wilson	New park record
	Dipsacales	Caprifoliaceae	*Symphoricarpos orbiculatus* Moench	New park record
	Dipsacales	Caprifoliaceae	*Viburnum nudum* L.	New park record
	Ericales	Ericaceae	*Vaccinium fuscatum* Ait.	New park record
	Fabales	Fabaceae	*Desmodium rotundifolium* DC.	New park record; specimen vegetative
	Fagales	Betulaceae	*Betula lenta* L.	Last collected 1884
	Fagales	Fagaceae	*Quercus muhlenbergii* Engelm.	New park record
	Geraniales	Oxalidaceae	*Oxalis stricta* L.	Last collected 1915
	Juglandales	Juglandaceae	*Juglans nigra* L.	Replacement for lost voucher
	Lamiales	Lamiaceae	*Lycopus americanus* Muhl. ex. W. Bart.	New park record
	Polygonales	Polygonaceae	*Rumex altissimus* Wood	Replacement for voucher of uncertain identification
	Polygonales	Polygonaceae	*Rumex congomeratus* Murr.	New park record; Fairfax Co. record
	Primulales	Primulaceae	*Lysimachia vulgaris* L.	New park record
	Ranunculales	Ranunculaceae	*Thalictrum dioicum* L.	Last collected 1915; specimen vegetative
	Ranunculales	Ranunculaceae	*Thalictrum pubescens* Pursh	New park record
	Rhamnales	Vitaceae	*Parthenocissus quinquefolia* (L.) Plach.	Replacement for lost voucher
	Rhamnales	Vitaceae	*Vitis aestivalis* Michx. var. *aestivalis*	Last collected 1941
	Rhamnales	Vitaceae	*Vitis cinerea* (Englem.) Millard	New park record
	Rhamnales	Vitaceae	*Vitis vulpina* L.	Replacement for lost voucher
	Sapindales	Aceraceae	*Acer nigrum* Michx.f.	New park record
	Sapindales	Aceraceae	*Acer saccharum* Marsh. var. *saccharum*	New park record
	Solanales	Cuscutaceae	*Cuscuta pentagona* Engelm.	Last collected 1922
Pteridophyta	Polypodiophyta	Dryopteridaceae	*Cystopteris protrusa* (Weath.) Blasd.	New park record

Turkey Run Parks (GWMP, VA), and the CHOH, MD (C. Fleming). The team contributed a combined total of 24 hours in the field (including preparation and travel time), and 8 hours on specimen preparation and identification (including report writing) for a grand total of 32 hours (Table 25).

Triclad planarians

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Aquatic planarians were sought in the CHOH, specifically in and around the Great Falls Visitors Center, and the canal for approximately one mile downstream. To my knowledge, the only previous survey within this region was conducted by Norden (1978), who reported one species, *Dugesia dorotocephala* (Woodworth), from Great Falls, but the record was inadvertently omitted in Norden, et al. (1992). The triclad planarian fauna of Plummers Island (CHOH) was recently reviewed (Norden, 2008a).

Aquatic planarians were sampled at the following two locations during the BioBlitz:

1. Carroll Branch and its tributaries in mature deciduous forest just above the parking area at Great Falls Park (CHOH, MD). Planarians were sought under rocks and logs in the stream, and under sparse accumulations of fallen deciduous leaves.

2. The C&O Canal from the Great Falls Visitor Center to a point about 1 mile downstream. The canal is filled with dense patches of *Hydrilla*, and there were scattered patches of gravel and rock substrate, and accumulations of fallen deciduous leaves.

Four species of triclad planarians (Order Polycladida) were found within CHOH during the BioBlitz. Each species is briefly discussed below.

Family Dugesidae

Dugesia tigrina (Girard). This is the most abundant and widespread aquatic planarian in Maryland (Norden et al., 1992). It occurs in a wide variety of relatively clean freshwater habitats. Individuals were found in masses of *Hydrilla* and in accumulations of leaf litter and other detritus in the canal. It is also expected to occur in quiet areas of the Potomac River.

Dugesia dorotocephala (Woodworth). This large species was found in abundance in 1975 at a spring-fed stream trickling down a steep rock face at Great Falls (Norden, 1978). This site could not be relocated during the BioBlitz survey. However, there is no reason to believe that *D. dorotocephala* does not still inhabit clean, cool high order tributaries of the Potomac River within the park.

Family Planariidae

Phagocata gracilis (Leidy). This distinctive, large, polypharyngeal species is easily recognized. It was found in small numbers in Carroll Branch just above the entry kiosk at the Great Falls Visitor Center. Individuals were found under leaves and small rocks in a clear stream running through mature deciduous forest.

Phagocata morgani (Stevens & Boring). This small, unpigmented planarian is one of the typical invertebrate inhabitants of clean springs west of the Fall Line in Maryland. Small numbers were found under rocks along with the much larger, darkly pigmented *P. gracilis* in Carroll Creek.

Several additional species of aquatic triclad planarians are expected to occur in the Great Falls portion of the park. *Cura foremani* (Girard) is likely to occur in tributary streams. Two vernal pool species, *Hymanella retenuova* Castle and *Phagocata velata* Stringer, are also expected; *P. velata* inhabits springs during the late winter/early spring months. Both species are found among fallen leaves at the bottom of vernal pools.

Team leader Arnold Norden was the sole member of the triclad planarian survey team. He contributed a combined total of 7 hours in the field (including preparation and travel time) and 6 hours on specimen preparation and identification (including report writing) for a grand total of 13 hours (Table 25).

Land snails

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The terrestrial snail fauna of Great Falls Park (CHOH, MD) and the GWMP, VA appear to be healthy and diverse. Ken Hotopp (Hotopp & Evans, 2005) conducted a survey of Great Falls Park (CHOH, MD) and found 27 species. His vouchers are deposited in the NPS collection at Turkey Run Park (fide B. Steury, NPS, GWMP, VA). A review of the Plummers Island (CHOH) fauna was published by Norden (2008b).

Four introduced taxa, all slugs, were observed, including *Arion hortensis* complex, *A. intermedius* (Normand), *A. subfuscus* (Draparnaud), and *Limax maximus* Linnaeus. Each of these species is widespread throughout the region and is expected to occur in the Potomac Gorge.

Two snail species found during the BioBlitz are particularly worthy of note. *Pomatiopsis lapidaria* (Say) is an infrequently collected species that has previously been reported in Maryland from Anne Arundel and Cecil counties, as well as the Eastern

Shore (Hubricht, 1985). During the BioBlitz a population was found around a vernal pool adjacent to a stone retaining wall supporting the towpath trail, just downstream of the Visitor Center at Great Falls Park (CHOH, MD); this represents a new record for the park. Another infrequently collected species, *Punctum smithi* Morrison, was found under leaf litter in the same area as *P. lapidaria*.

The land snail survey team recorded 35 species of snails and two species of freshwater mussels (Table 6) during the BioBlitz. The members of the survey team were Arnold Norden (team leader), Tim Pearce, Maureen Dougherty, Kim Harrell, Aydin Orstan, Megan Paustian, Mary Travaglini, and Ralph Webb. They contributed a combined total of 50 hours in the field (including preparation and travel time) 20 hours on specimen preparation and identification (including report writing) for a grand total of 70 hours (Table 25).

Table 6. Snails (Mollusca, Gastropoda) and freshwater mussels (Mollusca, Bivalvia) documented during the Potomac Gorge BioBlitz, 23-25 June 2006. C & O Canal National Historical Park, MD. Asterisks (*) denote new records for the Potomac Gorge.

CLASS	ORDER	FAMILY	SPECIES
Gastropoda	Archaeogastropoda	Pomatiopsidae	*Pomatiopsis lapidaria* (Say)*
	Basommatophora	Physidae	*Physa* sp.
	Neotaenioglossa	Hydrobiidae	*Fontigens* sp. probably *bottimeri*
		Pleuroceridae	*Elimia virginica* (Say)
	Stylommatophora	Arionidae	*Arion hortensis* complex
			Arion intermedius (Normand)*
			Arion subfuscus (Draparnaud)
		Cochlicopidae	*Cochlicopa lubrica* (Muller)
		Discidae	*Anguispira alternata* (Say)
			Anguispira fergusoni (Bland)
		Gastrocoptidae	*Gastrocopta contracta* (Say)
			Gastrocopta pentodon (Say)
			Striatura meridionalis (Pilsbry & Ferriss)
			Ventridens ligera (Say)
			Ventridens supressus (Say)
			*Zonitoides arboreus (Say)**
		Haplotrematidae	*Haplotrema concavum* (Say)
		Helicodiscidae	*Helicodiscus parallelus* (Say)*
		Limacidae	*Deroceras* nr. *hirsutum*
			Limax maximus Linnaeus
		Philomycidae	nr. *Megapallifera* sp.
			Philomycus carolinianus (Bosc)
		Pisidiidae	*Musculium partumeium* (Say)
			nr. *Pisidium* sp.
		Polygyridae	*Mesodon thryoidus* (Say)
			Stenotrema nr. *hirsuta*
			Triodopsis juxtidens (Pilsbry)
		Punctidae	*Punctum minutissimum* (I. Lea)
			Punctum smithi Morrison
			Punctum vitreum H.B Baker*
		Strobilopsidae	*Strobilops aeneus* Pilsbry
			Strobilops labyrinthica (Say)
		Vitrinidae	*Hawaiia miniscula* (A. Binney)*
		Zonitidae	*Glyphyalinia indentata* complex
			Glyphyalinia wheatleyi (Bland)
Bivalvia	Unionoida	Unionidae	Unionidae sp.
	Veneroida	Corbiculidae	*Corbicula fluminea* (Müller)

Subterranean macroinvertebrates

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Subterranean macroinvertebrates (Crustacea, Malacostraca; Mollusca, Gastropoda) were documented in the Potomac Gorge as early as 1883 with the discovery of the eyeless and unpigmented amphipod, *Stygobromus tenuis potomacus* (Holsinger) (Holsinger, 1976). Since then, additional collecting in Washington, D.C. and the immediate surrounding areas of Maryland and Virginia has revealed a rich diversity of species within the subterranean genus *Stygobromus*. The local diversity of this subaquatic genus is surpassed in the United States only by the Edwards Aquifer in Texas (Feller, 1997a, b; Hobson, 1997; Culver & Sereg, 2004).

The Potomac Gorge *Stygobromus* fauna is comprised primarily of three species on the Virginia side, two of which also occur in Maryland. Other groundwater-limited species include the Appalachian spring snail (*Fontigens bottimeri* Walker) that is found in both Maryland and Virginia, and a possibly undescribed species of isopod (*Caecidotea* sp., Hobbsi group) from Maryland.

Two general areas of seeps and springs were selected for inventory during the BioBlitz (both in CHOH, MD). These included the Glen Echo Quarry (springs 1, 2, 3) and a previously unsurveyed area south of Great Falls Tavern in the Gold Mine Tract. Glen Echo Quarry springs were a high priority to obtain additional specimens of the possibly undescribed *Caecidotea* sp. based on a single example collected in 1996 and to further sample amphipod species.

The two *Fontigens* specimens collected during the BioBlitz could not be positively verified to species due to difficulty in observing the penis, but are almost certainly *F. bottimeri*. Shell characteristics are consistent with *F. bottimeri* and *F. orolibas* Hubricht, but all previous records of this genus in Montgomery Co., MD, surrounding counties, and in immediately adjacent springs are assigned to *F. bottimeri*. Furthermore, *F. orolibas* is known only from the Blue Ridge and Ridge and Valley physiographic provinces, whereas the type locality for *F. bottimeri* is in nearby Glen Echo.

New site locality records for *Stygobromus pizzinii* (Shoemaker), *S. tenuis potomacus*, and *Fontigens* (prob. *bottimeri*) were documented during the BioBlitz, but all were known previously to occur in the Potomac Gorge.

A single immature specimen of *Caecitodea* was collected at Glen Echo Quarry spring. Additional mature males of this lightly pigmented but otherwise subterranean species were sought to aid species identification and description, but to no avail.

The best time to sample for these organisms at spring and seep emergences is typically in late winter to early spring. The sampling effort during the BioBlitz was therefore less than optimal due to lower groundwater flow rates.

In Maryland, *Stygobromus pizzinii* is ranked G2G4/S1, and *S. tenuis potomacus* G4T3T4Q/S3, while *Fontigens bottimeri* is G2/S2. The only non-native isopod observed at springs and seeps is the terrestrial/semi-aquatic *Haplothalmus danicus* Budde-Lund, a widespread species from Europe.

The subterranean macroinvertebrate survey team collected or observed one snail (Table 6), three amphipods, and three isopods (Table 7). The team members were Daniel J. Feller (team leader) and Jennifer A. Selfridge, who contributed a combined total of 16 hours in the field (including preparation and travel time) and 8 hours on specimen preparation and identification (including data entry, report writing, specimen transfer to NPS) for a grand total of 24 hours (Table 25).

Crustaceans

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Freshwater crustaceans have historically received little attention in faunistic inventories throughout North America (Thorp & Covich, 2001). Of the crustacean groups likely to be present in the full range of freshwater habitats, decapods, specifically crayfishes, have received the most attention. The larger anostracans (fairy, clam, and tadpole shrimps) of temporary water bodies have also been well-studied in certain parts of the continent. However, relatively little effort has focused on micro-crustaceans, specifically copepods (Williamson & Reid, 2001). During the Potomac Gorge BioBlitz, Loughman focused on freshwater crayfishes (Cambaridae), while Reid inventoried free-living copepods in an effort to document species that inhabit Great Falls Park (GWMP, VA).

Table 7. Amphipods and isopods (Crustacea) documented during the Potomac Gorge BioBlitz, 23-25 June 2006 at CHOH, MD. (GF=Great Falls Tavern; LF=Little Falls Tavern; RI=Rocky Islands).

ORDER	FAMILY	SPECIES	GF	LF	RI
Amphipoda	Crangonyctidae	*Crangonyx shoemakeri* (Hubricht & Mackin)	X	X	
		Stygobromus pizzinii (Shoemaker)		X	X
		Stygobromus tenuis (Smith)		X	
Isopoda	Asellidae	*Caecidotea kenki* (Bowman)	X	X	
		Caecidotea sp. (Hobbsi sp. group)		X	
	Trichoniscidae	*Haplothalmus danicus* Budde-Lunde		X	

Table 8. Sites sampled for crayfishes in Great Falls Park (GWMP, VA) during the Potomac Gorge BioBlitz, 23-25 June 2006.

Site	Location	Latitude	Longitude	Habitat Type
1	Large eddy immediately adjacent to Clay Pond parking lot	39.0050	77.2555	Potomac River Mainstem
2	Potomac River immediately below Georgetown aqueduct	39.0067	77.2544	Potomac River Mainstem
3	Potomac River Pool 150 meters upstream of aqueduct	39.008	77.2539	Potomac River Mainstem
4	Potomac River side channel 0.2 mi south of Georgetown aqueduct along River Trail	39.0047	77.2588	Potomac River Eddie
5	Confluence of Mine Run Branch/Potomac Canal	38.9997	77.2561	Canal
6	Potomac Canal 0.2 mi south of Mine Run Branch/Potomac Canal confluence	38.9992	77.2555	Canal
7	Potomac Canal 0.4 mi south of Mine Run Branch/Potomac Canal confluence	38.9981	77.2546	Canal
8	Difficult Run at cross-country trails trail head	38.976	77.2448	Stream
9	Mine Run Branch plunge pool immediately upstream of Park Rd. Culvert	38.9992	77.2567	Second Order Stream
10	Mine Run Branch 0.2 mi upstream of Park Rd. Culvert	39.0000	77.2572	Second Order Stream
11	Mine Run Branch plunge pool immediately down stream of Park Rd. Culvert	38.9998	77.2565	Second Order Stream
12	First-order tributary to Mine Run Branch 0.2 mi east of Mine Run Branch	39.0033	77.2594	First Order Stream
13	Mine Run Branch pool immediately below River Trail	38.9997	77.2564	Second Order Stream
14	Unnamed headwater tributary on river trail 0.8 mi north of River Trail trail head	39.0086	77.2542	Headwater Stream
15	Bank of Clay Pond between Park Road and pond margin	39.0007	77.2569	Bottom Land Forest
16	Swamp trail adjacent to talus slope	38.9896	77.2542	Bottom Land Forest
17	Stream fed Skunk Cabbage Swamp 0.2 mi from S entrance to Swamp Trail	38.9862	77.2488	Bottom Land Forest
18	Stream fed Skunk Cabbage Swamp adjacent to 2nd foot bridge along Swamp Trail	38.9867	77.2517	Bottom Land Forest
19	Unnamed tributary running under 2nd foot bridge along Swamp Trail	38.9892	77.2517	Headwater Stream
20	Ditch alongside first parking area at Swamp Trail trail head	38.9931	77.2531	Headwater Stream

Crayfish results. Four species of crayfish were collected from the Potomac Gorge (see photo on inside back cover; Tables 8, 9). Two species, *Cambarus diogenes* Girard and *Orconectes virilis* (Hagen) were recorded in the park prior to the BioBlitz survey. *Cambarus bartonii* (Fabricius) and *Orconectes limosus* (Rafinesque) were also collected within the park's boundaries and represent new additions to the Potomac Gorge crayfish fauna. Natural history observations and potential conservation concerns are listed below for each of the species observed during the BioBlitz.

Appalachian Brook Crayfish, *Cambarus* (*Cambarus*) *bartonii bartonii* (Fabricius). Individuals were collected from headwater and second order streams throughout the park. Robust populations were present in streams feeding "The Swamp", Mine Run Branch, and associated tributaries. An additional individual was collected from the Potomac Canal at the confluence of Mine Run Branch. In headwater situations, *C. bartonii* burrows were present in stream banks and throughout stream substrates. Lotic habitats with a mixed gravel/cobble substrate, mesophytic canopy, and abundance of slab boulders supported the largest populations of this crayfish.

Appalachian brook crayfishes are likely to inhabit the Potomac Canal in limited numbers during active hydroperiods. Their population probably recedes into Mine Run Branch during periods of drawdown. This species requires highly oxygenated water across its range. The eutrophic nature of the Potomac Canal and Potomac River upstream of the aqueduct adjacent to the park likely represent environmental stressors not conducive to the success of *C. bartonii* populations (Crocker & Bar, 1968; Hobbs, 1981; Jezerinac et al., 1995).

Northern Crayfish, *Orconectes virilis* (Hagen). This species is a highly successful competitor and its presence is very likely a detriment to *C. bartonii*. As a result, *O. virilis* represents an important source of imperilment for the Appalachian brook crayfish in this and other habitats where the two initially coexist. This competitive exclusion was exemplified by observations of a population of *C. bartonii* in Mine Run Branch. The main park road where the stream is directed through a culvert running underneath the road divides its population with that of *O. virilis*. Only one individual of *C. bartonii* was collected in the Mine Run Branch from the downstream culvert plunge pool to the confluence with Potomac Canal. In this same stream reach, *O. virilis* now lives in habitats once likely occupied by *C. bartonii*. Stream reaches upstream of the culvert were dominated by *C. bartonii*; only one *O. virilis* was observed in the same area. This individual had been partially consumed, and possibly relocated there by a predator.

Spiny-cheeked Crayfish, *Orconectes* (*Faxonius*) *limosus* (Rafinesque) were collected in the Potomac River mainstem and Difficult Run. Potomac River populations were limited to eddies and littoral zones. No individuals were collected from the stream channel; further investigations are warranted to determine if they utilize channel habitats. Only one specimen was collected from Difficult Run, which was flooding during the survey, thus making sampling of this stream both difficult and dangerous; the low sample size should not be interpreted as low population size. Future collecting efforts on this stream are required to determine the extent of the *O. limosus* population. Difficult Run's course of sandy substrate is typical habitat for this crayfish and further sampling may reveal large populations in this stream and its associated watershed.

Orconectes limosus is native to the region and is known historically to inhabit shallow pools and runs with moderate to no current, sandy substrates, decreased macrophyte growth, and more extreme daily temperature fluctuations (Meredith & Schwartz, 1960). Within the Potomac River and elsewhere, this species is currently undergoing extirpation due to competitive exclusion by *O. virilis* (see Schwartz et al., 1963). Stream microhabitats (pools and runs) historically occupied by *O. limosus* are now occupied exclusively by *O. virilis*. During the BioBlitz, it was observed that habitats typically favored by *O. limosus* were utilized by increased numbers of juvenile *O. virilis*. By occupying these habitats, the juveniles were able to mature by avoiding prime microhabitats occupied by large adult *O. virilis*.

Devil Crayfish, *Cambarus* (*Lacunicambarus*) *diogenes* (Girard). The devil crayfish is a burrowing species that lives in all aquatic habitats within the park except the Potomac River mainstem. Though found primarily in lotic habitats, *C. diogenes* also occurs in some lentic situations in the myriad of ephemeral wetlands throughout the park. Robust populations were present surrounding Clay Pond and in the banks of Mine Run Branch. A thriving population is present in "The Swamp", an ephemeral wetland system dominated by skunk cabbage, *Symplocarpus foetidus* (Linnaeus) and red maple, *Acer rubrum* Linnaeus. This crayfish is also present in sub-optimal habitats such as the lawn around the Visitor Center and the main picnic areas within the park. The burrows of *C. diogenes* consist of a central shaft 0.2-0.7 m deep ending in an enlarged resting chamber. Radiating from the bottom of the chamber are 1-4 ancillary tunnels extending an additional 0.3-0.7 m. Standing water was present in all successfully excavated burrows. Seventy-six percent of

Table 9. Crayfish morphometrics and site information collected in Great Falls Park (GWMP, VA) during the Potomac Gorge BioBlitz, 23-25 June 2006. Carapace length (CPL) is in millimeters. Form I male (IM), Form II male (IIM), and female (F) data are presented. Site numbers as in Table 8. * = Species previously unrecorded in the park; ** = invasive species.

Species	N	Demographics	CPL Range	Mean CPL	Sites
*Cambarus bartonii**	25	14 IIM, 1 IM, 10 F	10.5 – 36.8	23.4	5, 9, 10, 12, 13, 14, 16, 17, 18, 19, 20
Cambarus diogenes	8	3 IIM, 5 F	28.6 – 47.1	36.4	14, 15, 16, 17, 18
*Orconectes limosus**	5	4 IIM, 1 F	3.8 – 31.9	23.7	2, 8
*Orconectes virilis***	53	30 IIM, 1 IM, 21 F	9.7 – 51.4	30.3	1, 2, 3, 4, 5, 6, 7, 11, 12, 13

burrows excavated with crayfish had chimneys.

One burrow excavated at Site 17 (Table 8) was occupied by a female and 50+ neonates. The resting chamber of the burrow contained detritus composed of *Acer* leaves in various stages of decay, with the leaves showing evidence of mastication by the neonates. Given the carapace lengths of the neonates, it is likely that egg extrusion within this population occurs in late winter or early spring. This matches similar extrusion dates for lacunicambarid crayfishes across eastern North America (Hobbs, 1981; Jezerinac et al., 1995; Taylor & Schuster, 2005). Previous research on this species in the region included an analysis of abiotic conditions within burrows on Theodore Roosevelt Island (Grow & Merchant, 1980).

Crayfish discussion. The crayfish fauna of the Potomac Gorge surveyed during the BioBlitz is not speciose and consists of three native and one invasive species. This is to be expected given the distance of the Gorge's ecoregion from the Southern Appalachians where crayfish diversity reaches its peak in North America (Taylor et al., 1996). The native crayfish fauna of the Potomac Gorge consists of *O. limosus* occupying the Potomac River mainstem and large streams, *C. bartonii* inhabiting headwater and second order streams, and *C. diogenes* fulfilling the primary burrower niche (see Norden, 2008c). This species assemblage and associated habitat preferences are homogeneous throughout the Coastal Plain and Piedmont ecoregions from New York south through northern Virginia (Crocker, 1979).

Virile crayfish (*O. virilis*) demonstrated high microhabitat plasticity and were collected in all lotic environments. Robust populations were present in the Potomac River, Potomac Canal, and Mine Run Branch downstream of the main park road culvert. Individuals took cover beneath slab boulders and various types of debris on the bottom of the Potomac River, whereas macrophyte beds were the preferred microhabitat in the Potomac Canal. Mine Run Branch populations used boulders, crevices on stream bottoms, and detritus beds in pool thalwegs as retreats. Antagonistic interactions were observed between large conspecific males over burrows in Mine Run Branch, indicating a degree of territoriality among adult males.

Orconectes virilis, native to the Midwest, represents a serious threat to the native species of crayfish in the Potomac Gorge, especially *C. bartonii* and *O. limosus*, by occupying preferred microhabitats in streams and forcing native crayfishes into exposed microhabitats (see Hobbs et al., 1989; Lodge et al., 2000a, b). Under these suboptimal conditions native crayfishes are exposed to higher predation rates by fish and other environmental stressors (Capelli & Munjal, 1982). Additionally, invasive orconectids are known to interbreed with native orconectids producing hybrid swarms (Butler, 1988). Future investigations should focus on this phenomenon within the Potomac Gorge to determine if this is also a potential source of imperilment.

Previous work in the Patasco River, Maryland, demonstrated the success of *O. virilis* in extirpating *O. limosus* (Schwartz et al., 1963). *Cambarus bartonii* populations will likely only be impacted in confluences of creeks with the Potomac River because of their secondary burrower life history traits and the reluctance of *O. virilis* to invade headwater streams (Hobbs, 1981). Headwater populations of *C. bartonii* represent potential stock for reintroduction of this species in waters where they have been extirpated by *O. virilis*, assuming that populations of the latter can be controlled or eliminated in some way. Unfortunately, no adequate control methods have been devised to halt the expansion of invasive crayfishes throughout watersheds (Lodge et al., 2000a, b).

Future survey efforts should focus on determining the true extent and nature of *O. virilis* within the Potomac Gorge, surveying for additional species not found during the BioBlitz, and monitoring and managing of the imperiled *O. limosus*. In other parts of its range, *O. limosus* is being extirpated at an accelerated pace due to competition with *O. virilis* and there is no reason to think that this phenomenon is not occurring in Great Falls Park. The headwaters of Difficult Run appear to be a naturally protected refugium blocking the expansion of *O. virilis*. The park's burrowing crayfish populations appear to be stable. As long as "The Swamp" remains undisturbed and intact, *C. diogenes* will continue to thrive within the park's margins.

The Louisiana red crayfish, *Procambarus clarkii* (Girard), commonly raised in aquaculture, is an important invasive species throughout the United States, and is very likely to reside within Great Falls Park (GWMP, VA) (Hobbs et al., 1989). Recent investigations in Maryland and Virginia have documented the escape of this species from controlled situations (J. Kilian, MDNR, pers. comm.). Currently, *P. clarkii* has been documented in the Potomac River mainstem and tributaries throughout the Chesapeake Bay Lowlands. Future survey efforts in the park for this invasive species should focus on the Potomac River mainstem below the Falls. Surveys should also be performed in the CHOH, Maryland to determime if populations are present there. Studies on fish indicate that it is likely that the canal would be utilized by these invasive crayfishes as a corridor given its lentic, slough-like nature (Starnes, 2002).

The digger crayfish, *Fallicambarus fodiens* (Cottle) (formally known as *F. uhleri* [Faxon]), is present throughout the Chesapeake Bay lowlands and Atlantic Coastal Plain ecoregions. Given the close proximity of Great Falls Park to these ecoregions, insular populations may exist in the Potomac Gorge (B. Norden, MDNR, pers. comm.). This native species is a primary burrower and should occur in "The Swamp" and other bottomland environments.

Three additional species of *Procambarus* potentially inhabit the park. *Procambarus acutus* Girard, or White River crayfish, is a secondary burrower associated with wetland sloughs, ponds, and slow-moving streams (Page, 1985; Taylor & Schuster, 2005). This species is present in similar habitats surrounding the park and potentially resides within its borders. Future surveys for this native species should focus on wetlands and ephemeral lentic situations. A closely related species with similar habitat requirements, the Southern White River crayfish (*P. zonangulus*), was recently discovered residing in several wetlands surrounding the greater Washington, DC area in Maryland (J. Kilian, MDNR. pers. comm.). This species is virtually identical to *P. acutus*; distinguishing these two species is difficult.

Copepod results. Twenty species of copepods were found in the samples collected on 23 June (Tables 10, 11). There are no prior records of copepods from Great Falls Park (GWMP, VA), but a review of the Plummers Island fauna was published by Wyngaard & Reid (2008). Brief comments on the local natural history and distribution of each species follows. Further information for many of the species is found in the compendium of Hudson & Lesko (2003).

Table 10. Sites sampled for copepods (Crustacea) in Great Falls Park (GWMP, VA) during the Potomac Gorge BioBlitz, 23 June 2006.

Site	Location	Habitat Type
1	Clay Pond, plankton, 39° 00' 04"N, 77° 15' 25"W	Permanent Pond
2	Clay Pond, mud at edge, 39° 00' 03"N, 77° 15' 25"W	Permanent Pond
3	Clay Pond, damp moss on dead tree limbs just above waterline, 39° 00' 03"N, 77° 15' 25"W	Bottomland Forest
4	Patowmack Canal near north parking lot, plankton, 38° 59' 57"N, 77° 15' 19"W	Canal
5	Culvert entering Patowmack Canal near north parking lot [no copepods]	Canal
6	Slough depression west of path north of Clay Pond [no copepods]	Bottomland Forest
7	Moss on ground beside same slough depression, 39° 00' 20"N, 77° 15' 20"W	Bottomland Forest
8	Boggy depression with skunk cabbage, just west of north parking lot, wet soil, 38° 59' 56"N, 77° 15' 23"W	Bottomland Forest
9	Mine Run, hole dug in sand and gravel bar in streambed, 38° 59' 59"N, 77° 15' 30"W	Second Order Stream
10	Seep GRFA2 entering Mine Run, upper cm of sandy bed, 38° 59' 59"N, 77° 15' 28"W	First-order Seep
11	Seep GRFA2 entering Mine Run, muddy soil, 38° 59' 59"N, 77° 15' 28"W	First-order Seep
12	Seep GRFA2 entering Mine Run, moss, 38° 59' 59"N, 77° 15' 28"W	First-order Seep
13	Seep GRFA4 crossing Swamp Trail, wet leaves in tiny leaf dam, 38° 59' 18"N, 77° 15' 12"W	First-order Seep

Osphranticum labronectum S.A. Forbes. This large, brownish to steel-gray species is the only calanoid that occurred in the samples. It is widespread in North America from central Canada to Central America, inhabiting mainly temporary waters but sometimes occurring in shallow, permanent lakes and swamps. A large population was found in a temporary pool on the Chain Bridge Flats (CHOH, MD) during the 1997 BioBlitz (Reid, 1997). In Virginia, it has been found in Lee and Charlotte counties, Chesapeake and Suffolk cities, and also in Black Pond in Great Falls Park in Fairfax County (Reid, unpub. data).

Acanthocyclops einslei Mirabdullayev & Defaye. This species is perhaps the most interesting find of the BioBlitz. It is a recently described morph of the taxonomically confusing and controversial vernalis-robustus group. Its authors reported it from France, Sumatra, Canada (Ontario), and Lake Erie on the New York side (Mirabdullayev & Defaye, 2004). This is the first record in Virginia, although existing collections need to be reexamined.

Ectocyclops phaleratus (Koch) is a small species that creeps along bottom sediments and the surface of water plants, mostly in ponds, sloughs, and bogs. It is supposedly cosmopolitan, with records from nearly every continent, and is widespread in Virginia (Reid, unpub. data).

Eucyclops agilis (Koch) and *E. conrowae* Reid are both small, primarily benthic species that are widespread in both North America and in Virginia (Reid, unpub. data). They are found in a wide range of stillwater habitats, from lakeshores to small creeks and seeps.

Macrocyclops albidus (Jurine) is a cosmopolitan inhabitant of lakes, ponds, and smaller lentic waterbodies. It thrives in eutrophic conditions. It is the most commonly found species in Virginia (Reid, unpub. data).

Mesocyclops americanus Dussart occurs in small, permanent or ephemeral ponds in central and eastern North America, from southeastern Canada to the Florida Everglades. This is the fourth record in Virginia, where it has been found mainly on the Coastal Plain (Reid, unpub. data).

Paracyclops chiltoni (Thomson) is one of the few species of the genus that is considered truly cosmopolitan (Karaytug, 1999). Many records of its similar congener, *P. fimbriatus* (Fischer), in North America undoubtedly refer to this species. *Paracyclops chiltoni* is extremely common in Virginia, where it is a typical inhabitant of small ponds, seeps, and bogs (Reid, unpub. data).

Paracyclops poppei (Rehberg), like its congener *P. chiltoni*, is considered to be cosmopolitan (Karaytug, 1999). Collections in Virginia, where it is widespread, indicate that this species is somewhat more likely to be found in tiny pools, sloughs, seeps, bogs, and wet soil.

Tropocyclops prasinus mexicanus Kiefer is one of the most common, smaller-sized zooplankters in natural lakes and impoundments across North America. Its occasional presence in streams is probably a result of washing from upstream lentic waterbodies. It is present throughout Virginia (Reid, unpub. data).

Attheyella (*Neonrazekiella*) *illinoisensis* (S.A. Forbes) is another species that is widespread in North America. It is the most typical inhabitant of muddy seeps and lake margins in Virginia (Reid, unpub. data).

Bryocamptus (*Bryocamptus*) *zschokkei* (Schmeil) is a small (length ~0.5 mm), widespread, and extremely common harpacticoid that is circumboreal and common in Arctic, boreal, and temperate regions. In southern Virginia, it is restricted to the upper Piedmont, Blue Ridge, and Valley and Ridge provinces; in northern Virginia, it occurs occasionally in the lower Piedmont in the vicinity of Washington, DC (Reid, unpub. data).

All of the species of *Bryocamptus* live in springs and in moist situations such as moss and wet soils. Most species in the genus prefer cold waters. *Bryocamptus* (*Bryocamptus*) *zschokkei alleganiensis* Coker is a small subspecies with almost the same distribution as *B. zschokkei zschokkei*, except that it is found somewhat farther east in the central Virginia Piedmont (Reid, unpub. data).

Bryocamptus (*Bryocamptus*) sp. (hutchinsoni group, Virginia variation described by Carter, 1944) is a morph known previously from the vicinity of Mountain Lake that Carter attributed to a variation of *B.* (*B.*) *hutchinsoni* Kiefer. Later workers have considered that species of the genus *Bryocamptus* are "variable," but this concept has been tested in very few species. This particular morph has been found in a few locations in the central Virginia Piedmont, and even in the Coastal Plain near Richmond (Reid, unpub. data).

Bryocamptus (*Bryocamptus*) sp. of the hutchinsoni group is another morph that does not agree with any previously described taxa.

Bryocamptus (*Limocamptus*) *morrisoni elegans* (Chappuis) is a relatively rare species known from very few locations in the eastern US. This is only the third record in Virginia, where it occurs also in Montgomery and Pittsylvania counties (Reid, unpub. data).

Bryocamptus (*Limocamptus*) *nivalis* (Willey) is relatively common in the Blue Ridge and upper Piedmont provinces (Reid, unpub. data), but its presence in Virginia has never been published.

Elaphoidella bidens (Schmeil) is a weedy species, common in disturbed locations and especially organically enriched waters. It develops large

populations in such habitats throughout Virginia (Reid, unpub. data). It does not closely resemble any other North American species, and may have been introduced onto this continent.

Moraria laurentica Willey, a member of a typically boreal genus, occurs in Virginia from the Valley and Ridge to the Coastal Plain provinces.

Phyllognathopus viguieri (Maupas) is the most "semiterrestrial" of all of the copepod species found during the BioBlitz. It is found in lake-bottom sediments, but more typically occurs among wet leaves, damp moss, and seeps. It occurs in these habitats all across Virginia (Reid, unpub. data).

Copepod discussion. As with the crayfishes, the assemblage of copepods observed during the BioBlitz is typical for the region and the kinds of habitats that were sampled. As usual, most of the species occur not in the plankton of open waters, but rather are associated with bottom sediments of open bodies of water, and various kinds of saturated to moist, semiterrestrial substrates. The prominence of members of the harpacticoid genus *Bryocamptus* is typical for such habitats.

Certainly this collection did not reveal all of the species that may be present in Great Falls Park. One potential habitat that was not thoroughly investigated is the sandy interstitial, "hyporheic" sediments of seeps and creeks. Furthermore, many species, especially those of ephemeral surface waterbodies, but also those of springs and seeps, are seasonal and may appear and disappear again within the span of a few weeks. Nevertheless, it is apparent that the Park harbors a wide array of subhabitats and a reasonable copepod fauna, including a few such as *Mesocyclops americanus* and *Bryocamptus morrisoni elegans* that, although widespread, are not often collected. The record of *Acanthocyclops einslei* is also rather surprising, and valuable, extending as it does the known distribution of this morph into Virginia.

Table 11. Copepod species collected in Great Falls Park (GWMP, VA) during the Potomac Gorge BioBlitz, 23-25 June 2006. None of the species was previously recorded in the park.

SPECIES	SITES*
Osphranticum labronectum S. A. Forbes	1
Acanthocyclops einslei Mirabdullayev & Defaye	2, 8
Ectocyclops phaleratus (Koch)	2, 8
Eucyclops agilis (Koch)	2
Eucyclops conrowae Reid	2
Macrocyclops albidus (Jurine)	2
Mesocyclops americanus Dussart	1
Paracyclops chiltoni (Thomson)	2, 3, 8, 11
Paracyclops poppei (Rehberg)	3, 8
Tropocyclops prasinus mexicanus Kiefer	2, 4
Attheyella (*Neomrazekiella*) *illinoisensis* (S. A. Forbes)	9, 10
Bryocamptus (*Bryocamptus*) *zschokkei* (Schmeil, 1893)	10
Bryocamptus (*Bryocamptus*) *zschokkei alleganiensis* Coker	7, 12, 13
Bryocamptus (*Bryocamptus*) sp. (hutchinsoni group)	3
Bryocamptus (*Bryocamptus*) sp. (hutchinsoni group, another morph)	8
Bryocamptus (*Limocamptus*) *morrisoni elegans* (Chappuis)	12
Bryocamptus (*Limocamptus*) *nivalis* (Willey,)	9, 11
Elaphoidella bidens (Schmeil)**	8
Moraria laurentica Willey	12
Phyllognathopus viguieri (Maupas)	7, 12

* See Table 10 for collection sites.
**Probably an invasive species.

Management practices for copepods should include avoiding the use of molt-inhibiting insecticides, and preventing silting and contamination by oils and other pollutants. Maintaining the natural forest cover over woodland pools is essential. Alterations to natural drainage patterns should be avoided.

Four species of crayfish and 20 species of copepods (Table 11) were recorded during the BioBlitz. None of the species encountered are listed as threatened, endangered, or globally or state rare.

The members of the crustacean survey team were Zachary Loughman (team leader), Janet Reid, Alex Kim, Laura Kimpel, Kathy Loughman, Stephanie Nelson, Tabitha Viner, and Christopher Vopal. Estimates of the total number of hours spent in the field, and specimen preparation and identification were not available.

Arachnids

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According to Brent Steury, Supervisory Biologist at Turkey Run Park (GWMP, VA), as well as a literature search, no previous work by amateur or professional workers has been conducted specifically on the arachnids of the Potomac Gorge region. However, many spiders have been collected in the Washington, DC area over the years and those results have appeared in monographs of individual families and genera and published in a wide variety of scientific journals.

The timing of the BioBlitz was not particularly favorable for arachnid collecting. Many species of spiders are immature in early summer and thus more difficult to identify. We did not find as many species as expected, perhaps at least partly due to the heavy visitor use of the park. Many of the species found are widespread in disturbed areas.

Most of the team members had no prior field experience conducting arachnid surveys. As a result, the team remained together in the field, sampling only Great Falls Park (GWMP, VA). This limited our geographical coverage and the amount of time we could collect and identify specimens in the field.

A total of 45 species of spiders and other arachnids were recorded during the BioBlitz, including four unidentified species each of harvestmen (Opiliones) and pseudoscorpions (Pseudoscorpiones) that are not listed in Table 12. Ticks and mites were not identified nor are they included in the species count. None of the species encountered are listed as threatened, endangered, or globally or state rare. All of the species collected were indigenous to the region.

The members of the Arachnid survey team were Barbara Abraham (team leader), James Forbes, Carolyn Marks, Peter Munroe, Sarah Abboud, Gerard Gomes, and Colin Funaro, Jr. They contributed a combined total of 96 hours in the field (including travel time), and 40 hours on specimen preparation and identification (including data entry, report writing, and specimen transfer to NPS) for a grand total of 136 hours (Table 25).

Dragonflies and damselflies

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Unlike most other arthropod groups in the Potomac Gorge, the dragonflies and damselflies have been surveyed several times over the past century. Orr (2005) provided the most recent and complete survey of the region, which includes all of the historical data.

During the 2006 Potomac Gorge BioBlitz, all of the odonates encountered were identified either by observed or collected adults or cast larval skins (exuviae). No fieldwork was undertaken on 25 June due to heavy rains.

Forty-six species of dragonflies and damselflies were recorded during the BioBlitz (Table 13), all of which are native to the region. None are listed as threatened, endangered, or globally rare. However, six species are of special interest in the District of Columbia, Maryland, and Virginia, including *Argia sedula* (Hagen) (MD-S3 natural heritage rank), *Enallagma traviatum* Selys (MD-S3), *Tachopteryx thoreyi* (Hagen) (DC-concern, MD-S2), *Erpetogomphus designatus* (Hagen) (MD-S2), *Gomphus fraternus* (Say) (MD-S2, VA-S2), *Neurocordulia obsoleta* (Say) (DC-concern, MD-S3), and *Neurocordulia yamaskanensis* (Provancher) (MD-S2, VA-S2).

The members of the Odonata survey team were Richard Orr (team leader), Michael Bean, Paul Bedell, Ken Clayton, Cathy and Angela Hutto, ZoAnn Lapinsky, Susan Muller, Steve, Tim, and Ben Roble, Charles and Karen Sheffield, Bob and Jo Solem, Ashley and Kate Traut, and June Tveekrem. They contributed a combined total of 242 hours in the field (including preparation and travel time) and 25 hours on specimen preparation and identification (including data entry, report writing, specimen transfer to NPS) for a grand total of 267 hours (Table 25).

Table 12. Spiders (Arachnida) documented during the Potomac Gorge BioBlitz, 23-25 June 2006. GWMP=George Washington Memorial Parkway, VA (GF=Great Falls Park; TR=Turkey Run Park); CHOH=C & O Canal National Historical Park, MD (CB=Chain Bridge Flats; GF=Great Falls Park; PI*= near Plummers Island).

FAMILY	SPECIES	GWMP		CHOH		
		GF	TR	CB	GF	PI*
Agelenidae	*Agelenopsis* poss. *kastoni* (Walckenaer)	X				
Araneidae	*Acacesia hamata* (Hentz)				X	
	Mangora maculata (Keyserling)	X				
	Metepeira labyrinthea (Hentz)	X				
	Micrathena gracilis (Walckenaer)	X				
	Neoscona arabesca (Walckenaer)				X	
	Neoscona domiciliorum (Hentz)				X	
	Neoscona prob. *arabesca* (Walckenaer)	X				
	Verrucosa arenata (Walckenaer)	X				
Corinnidae	*Castianeira variata* Gertsch	X	X			
Linyphiidae	*Frontinella communis* (Hentz)	X				
Lycosidae	*Allocosa funerea* (Hentz)	X				
	Pardosa milvina (Hentz)	X	X			
	Rabidosa rabida (Walckenaer)		X			
	Schizocosa ocreata (Hentz)	X				
Oxyopidae	*Oxyopes aglossus* Chamberlin	X				
	Oxyopes salticus Hentz	X				
Pisauridae	*Dolomedes* prob. *scriptus* Hentz					X
	Dolomedes scriptus Hentz	X				
	Dolomedes striatus Giebel (or *triton*)			X		
	Dolomedes vittatus Walckenaer	X				
	Pisaurina prob. *mira* (Walckenaer)	X				
Salticidae	*Habrocestum pulex* (Hentz)	X				
	Habronattus coecatus (Hentz)			X		
	Habronattus poss. *decorus* (Blackwall)				X	
	Phidippus princeps (Peckham & Peckham)	X				
	Phidippus sp.	X				
	Thiodina sylvana (Hentz)	X				
	Zygoballus rufipes Peckham & Peckham				X	
Tetragnathidae	*Leucauge venusta* (Walckenaer)	X			X	
	Tetragnatha elongata Walckenaer	X				
Theridiidae	*Anelosimus studiosus* (Hentz)	X				
	Faiditus cancellatus (Hentz)	X				
	Parasteatoda tepidariorum (C.L. Koch)	X				
Theridiosomatidae	*Theridiosoma gemmosum* (L. Koch)	X				
Thomisidae	*Misumenops oblongus* (Keyserling)				X	
	Xysticus fraternus Banks	X				

Table 13. Dragonflies and damselflies (Odonata) documented during the Potomac Gorge BioBlitz, 23-25 June 2006. GWMP=George Washington Memorial Parkway, VA (GF=Great Falls Park; Chain Bridge Flats); CHOH=C & O Canal National Historical Park, MD (CR=Carderock; GF=Great Falls Park).

FAMILY	SPECIES	GWMP		CHOH	
		GF	CB	CR	GF
Calopterygidae	*Calopteryx maculata* (Beauvois)	X	X	X	X
	Hetaerina americana (Fabricius)	X	X	X	X
Lestidae	*Lestes inaequalis* Walsh	X	X		
	Lestes rectangularis Say		X		X
Coenagrionidae	*Argia apicalis* (Say)	X	X	X	X
	Argia fumipennis (Hagen)	X		X	X
	Argia moesta (Hagen)	X	X	X	X
	Argia sedula (Hagen)	X	X		
	Argia tibialis (Rambur)	X	X	X	X
	Argia translata Hagen in Selys	X		X	X
	Enallagma basidens (Calvert)				X
	Enallagma civile (Hagen)			X	X
	Enallagma exsulans (Hagen)	X	X	X	X
	Enallagma geminatum Kellicott			X	X
	Enallagma signatum (Hagen)			X	X
	Enallagma traviatum Selys				X
	Ischnura kellicotti Williamson				X
	Ischnura posita (Hagen)	X	X	X	X
	Ischnura verticalis (Selys)	X	X		
Petaluridae	*Tachopteryx thoreyi* (Hagen)				X
Aeshnidae	*Anax junius* (Drury)				X
	Basiaeschna janata (Say)	X	X		
	Boyeria vinosa (Say)	X	X		
	Epiaeschna heros (Fabricius)	X	X		X
	Nasiaeschna pentacantha (Rambur)	X	X	X	X
Gomphidae	*Dromogomphus spinosus* Selys	X	X	X	X
	Erpetogomphus designatus Hagen	X	X	X	
	Gomphus fraternus (Say)		X		
	Gomphus vastus Walsh	X	X	X	X
	Hagenius brevistylus Selys		X	X	X
	Stylurus spiniceps (Walsh)	X	X	X	X
Macromiidae	*Macromia illinoiensis* Walsh	X	X		X
Corduliidae	*Epitheca princeps* (Hagen)	X	X	X	X
	Neurocordulia obsoleta (Say)	X	X	X	X
	Neurocordulia yamaskanensis (Provancher)		X		X
Libellulidae	*Erythemis simplicicollis* (Say)	X	X	X	X
	Libellula cyanea Fabricius		X		
	Libellula incesta Hagen	X	X	X	X
	Libellula luctuosa Burmeister	X	X		X
	Libellula lydia (Drury)	X	X	X	
	Libellula needhami Westfall	X	X		
	Libellula pulchella Drury		X		
	Libellula vibrans Fabricius				X
	Pachydiplax longipennis (Burmeister)	X	X	X	X
	Perithemis tenera (Say)	X	X	X	X
	Tramea carolina Linnaeus	X			X

Mayflies, stoneflies, caddisflies, and neuropteroids

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Over the last few years, surveys of mayflies, stoneflies, caddisflies, and lacewings and their relatives have been undertaken on Plummers Island (CHOH, MD) (Flint, 2008a, c) and in Great Falls and Turkey Run Parks (GWMP, VA). As a result, the fauna of the Potomac Gorge has become fairly well known; there were no surprises in the species tallied at the BioBlitz.

In general, the BioBlitz coincided with the high season for these insect orders. In spite of the good numbers of individuals, there were many species in all groups that, with emergence times typically earlier or later in the year, were apparently missed during the event. The heavy rains caused problems with the daytime net collections and the high waters made it difficult or impossible to get into many streams. The weather did not prevent these insects from being lured into light traps at night.

Light trapping produced the bulk of the specimens gathered during the BioBlitz. A total of 58 species was recorded, including seven mayflies (Ephemeroptera), five stoneflies (Plecoptera), four neuropterans (one lacewing, two antlions, one spongillafly; Neuroptera), and 42 species of caddisflies (Trichoptera) (Tables 14, 15). Of the seven species of mayflies, only five were readily identifiable to species. All of the species collected are native and, as far as is known, none of the species are listed as threatened or endangered, or as globally or state rare.

The members of the survey team were Oliver Flint (team leader), Blair Goodman, Diane Keefe, and Kurt Moser. They contributed a combined total of 36 hours in the field (including preparation and travel time) and 68 hours on specimen preparation and identification (including data entry, report writing, specimen transfer to NPS), for a grand total of 104 hours (Table 25).

Table 14. Mayflies (Order Ephemeroptera), stoneflies (Order Plecoptera), and neuropterans (Order Neuroptera) documented during the Potomac Gorge BioBlitz, 23-25 June 2006. GWMP=George Washington Memorial Parkway, VA (GF=Great Falls Park; TR=Turkey Run Park); CHOH=C & O Canal National Historical Park, MD (BI=Bear Island; CR=Carderock; GF=Great Falls Park; PI=Plummers Island).

ORDER	FAMILY	SPECIES	GWMP		CHOH			
			GF	TR	BI	CR	GF	PI
Ephemeroptera	Caenidae	*Caenis latipennis* Banks			X			
	Ephemeridae	*Hexagenia limbata* (Serville)*						
	Heptageniidae	*Leucrocuta aphrodite* (McDunnough)	X					
		Maccafferatium vicarium (Walker)		X				X
		Maccafferatium sp.			X			
		Heptageniidae sp. 1	X					
	Potamanthidae	*Anthopotamus myops* (Walsh)				X		
Plecoptera	Perlidae	*Acroneuria arenosa* (Pictet)	X	X				
		Agnetina annulipes (Hagen)	X					
		Agnetina flavescens (Walsh)	X					
		Neoperla clymene (Newman)	X	X	X	X		
	Perlodidae	*Isoperla* sp.	X					
Neuroptera	Chrysopidae	*Chrysoperla rufilabris* (Burmeister)				X		
	Myrmeleontidae	*Brachynemurus abdominalis* (Say)					X	
		Myrmeleon immaculatus DeGeer	X					
	Sisyridae	*Climacia areolaris* (Hagen)			X			X

* Recorded only at Glen Echo Park.

Table 15. Caddisflies (Trichoptera) documented during the Potomac Gorge BioBlitz, 23-25 June 2006. GWMP=George Washington Memorial Parkway, VA (GF=Great Falls Park; TR=Turkey Run Park); CHOH=C & O Canal National Historical Park, MD (BI=Bear Island; CR=Carderock; PI=Plummers Island).

FAMILY	SPECIES	GWMP		CHOH		
		GF	TR	BI	CR	PI
Glossosomatidae	*Protoptila georgina* Denning			X	X	
	Protoptila palina Ross		X	X		
Helicopsychidae	*Helicopsyche borealis* (Hagen)			X	X	
Hydropsychidae	*Cheumatopsyche analis* (Banks)				X	X
	Cheumatopsyche ela Denning			X		
	Cheumatopsyche minuscula (Banks)	X	X	X	X	
	Hydropsyche betteni Ross			X	X	
	Hydropsyche bronta Ross	X			X	
	Hydropsyche brunneipennis Flint & Butler			X	X	X
	Hydropsyche hageni Banks	X	X			
	Hydropsyche hoffmani Ross	X				
	Hydropsyche leonardi Ross	X	X	X		
	Hydropsyche ophthalmica Flint	X		X		
	Hydropsyche phalerata Hagen	X	X	X	X	
	Hydropsyche scalaris Hagen				X	
	Hydropsyche sparna Ross				X	
	Macrostemum zebratum (Hagen)		X	X		X
Hydroptilidae	*Hydroptila spatula* Morton	X		X		
	Orthotrichia aegerfsciella (Chambers)				X	
	Orthotrichia tarsalis (Hagen)	X			X	
	Oxyethira pallida (Banks)			X		
Lepidostomatidae	*Lepidostoma togatum* (Hagen)	X				
Leptoceridae	*Ceraclea flava* (Banks)	X		X		X
	Ceraclea maculata (Banks)	X		X	X	
	Ceraclea slossonae (Banks)	X	X	X	X	X
	Ceraclea tarsipunctata (Vorhies			X		
	Mystacides sepulchralis (Walker)	X				
	Nectopsyche exquisita (Walker)			X		X
	Nectopsyche pavida (Hagen)	X				
	Oecetis avara (Banks)	X	X	X	X	X
	Oecetis cinarescens (Hagen)			X		
	Oecetis ditissa Ross				X	
	Oecetis inconspicua (Walker)	X	X	X	X	X
	Oecetis persimilis (Banks)			X	X	
	Triaenodes flavescens Banks		X			
	Triaenodes ignitus (Walker)	X				
	Triaenodes injustus (Hagen)		X	X		X
Philopotamidae	*Chimarra aterrima* (Hagen)	X			X	
	Chimarra obscura (Walker)	X		X		
	Chimarra socia (Hagen)	X		X	X	
Polycentropidae	*Cyrnellus fraternus* (Banks)			X	X	
	Polycentropus cinereus Hagen		X	X	X	X

True bugs (Hemiptera: Heteroptera)

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This survey was the first organized collecting event for the true bugs in the area, though, historically, various researchers from the National Museum of Natural History and United States Department of Agriculture have worked this region since the late 19th century.

Overall, the collecting was relatively poor. Rain posed a particular problem and limited the amount of time that could be devoted to fieldwork. The number of taxa could easily have been doubled with sampling at multiple locations.

A total of 55 species of Heteroptera (Table 16) was recorded during the BioBlitz, none of which are listed as threatened or endangered, or as globally or state rare. Forty species were taken Maryland and 24 in Virginia. All of the species collected or observed, except one, are native to both states (Henry et al., 2008)

The members of the survey team were Thomas Henry (team leader) and Kathryn Ciulla. They contributed a combined total of 36 hours in the field (including preparation and travel time) and 10 hours on specimen preparation and identification (including data entry, report writing, specimen transfer to NPS) for a grand total of 46 hours (Table 25).

Table 16. True bugs (Hemiptera) documented during the Potomac Gorge BioBlitz, 23-25 June 2006. GWMP=George Washington Memorial Parkway, VA (GF=Great Falls Park; TR=Turkey Run Park); CHOH=C & O Canal National Historical Park, MD (BG=Billy Goat Trail; BI=Bear Island; CR=Carderock; GF=Great Falls Park).

FAMILY	SPECIES	GWMP		CHOH			
		GF	TR	BG	BI	CR	GF
Anthocoridae	*Amphiareus obscuriceps* (Poppius) **	X					
Berytidae	*Jalysus wickhami* Van Duzee						X
Blissidae	*Blissus leucopterus* (Say)			X			
Coreidae	*Acanthocephala terminalis* (Dallas)	X					
	Leptoglossus occidentalis Heidemann		X				
	Leptoglossus sp. prob. *phyllopus* (Linnaeus) (nymph)						X
	Coreidae sp. 1	X					
	Coreidae sp. 2	X					
Cydnidae	*Amnestus basidentatus* Froeschner	X					
	Corimelaena lateralis (Fabricius)		X	X			
	Corimelaena pulicaria (Germar)						X
	Galgupha sp. (nymph only)						X
	Sehirus cinctus (Palisot de Beauvois)			X			
Geocoridae	*Geocoris bullatus* (Say)			X			
Lygaeidae	*Neacoryphus bicrucis* (Say)	X					
Miridae	*Agnocoris pulverulentus* (Uhler)						X
	Ceratocapsus incisus Knight *	X					
	Ceratocapsus nigrellus Knight						X
	Corticoris signatus (Heidemann) *	X					
	Deraeocoris poecilis (McAtee) *	X					
	Dichrooscytus repletus (Heidemann)						X
	Hyaliodes harti Knight (nymphs only) *						X
	Hyaliodes vitripennis (Say) (nymphs only) *						X
	Lopidea robiniae (Uhler) (nymphs only) *						X
	Neolygus inconspicuus (Knight)						X
	Neolygus nyssae (Knight) *	X					
	Neolygus omnivagous (Knight) *						X
	Neurocolpus nubilus (Say)		X				X
	Neurocolpus tiliae Knight						X
	Parthenicus juniperi (Heidemann)						X
	Pilophorus uhleri Knight *						X
	Ranzovius clavicornis (Knight)						X

* indicates apparent new state record; ** indicates new Western Hemisphere record.

Table 16 (continued).

FAMILY	SPECIES	GWMP		CHOH			
		GF	TR	BG	BI	CR	GF
Nabidae	*Nabis roseipennis* (Reuter)	X					
Pachygronthidae	*Oedancala dorsalis* (Say)	X					X
Pentatomidae	*Acrosternum hilare* (Say)	X			X		X
	Banasa sordidus Stal	X			X		X
	Euschistus servus (Say)	X		X			X
	Euschistus tristigmus (Say)						X
	Menecles insertus (Say)	X					X
	Mormidea lugens (Fabricius)						X
	Oebalus pugnax (Fabricius)			X			
	Pnirontis modesta Banks	X					
	Pselliopus cinctus (Fabricius)						X
	Stenopoda cinerea Laporte	X					
Rhyparochromidae	*Harmostes fraterculus* (Say)						X
Rhopalidae	*Boisea trivittatus* (Say)						X
	Drymus crassus Van Duzee						X
	Heraeus plebejus Stal	X			X		X
	Myodocha serripes Olivier	X					
	Neopamera albocincta (Barber)	X					
	Ozophora picturata Uhler					X	X
	Pseudopachybrachius basalis (Dallas)			X			
Tingidae	*Corythucha marmorata* (Uhler)			X			
	Gargaphia tiliae (Walsh)						X
	Leptoypha mcateei Drake *						X

Scorpionflies

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The Order Mecoptera, known commonly as hangingflies, snow scorpionflies, earwig scorpionflies, and common scorpionflies, are represented in the United States by members of five families; Bittacidae, Boreidae, Meropeidae, Panorpidae, and Panorpodidae (Penny, 2005). The genera *Bittacus*, *Boreus*, *Merope*, and *Panorpa* have all been recorded from the Potomac Gorge region (Hoffman, 2002; Flint, 2008b).

Prior to the BioBlitz, the only mecopteran recorded from GWMP was *Panorpa helena* Byers. Flint (2008b) reported *Bittacus occidentis* Walker, *B. pilicornis* Westwood, *B. punctiger* Westwood, *B. stigmaterus* Say, *B. strigosus* Hagen, *Panorpa consuetudinis* Snodgrass, *P. helena* Byers, *P. isolata* Carpenter, and *P. maculosa* Hagen from Plummers Island (CHOH, MD). Several other species have been recorded for regions of Maryland and Virginia near CHOH and GWMP and would be expected to be found at both parks, including *P. dissimilis* Carpenter and *P. virginica* Banks (O. Flint, pers. comm.).

Boreus brumalis Fitch, commonly known as a "snow scorpionfly" or "snow flea," is a winter species that has been recorded from Plummers Island (Flint, 2008b) and several localities in Arlington and Fairfax counties, Virginia, including Riverbend Park near Great Falls (Hoffman, 2002). The earwig scorpionfly, *Merope tuber* (Meropeidae), also has been collected on Plummers Island, and there are additional records from nearby localities in Virginia and Maryland (Flint, 2008b).

The BioBlitz, which took place during the third week of June, occurred at a time when Mecoptera abundance is generally low and they are less likely to be encountered by collectors. As a result, the Mecoptera Survey found very few scorpionflies.

On 24 June, team leader Jones worked alone and covered the lower C&O Canal, Valley Trail, the Gold Mine Loop, and Plummers Island. Collecting was most productive in a grassy site west of Carderock on the northwestern bank of the Canal (see below), across from Vaso Island. Jones stirred up individuals as he walked through the grasses. Though somewhat cryptic with their clear wings and ability to abruptly grab a leaf to hang (Fig. 12) and virtually disappear into the shadows, bittacids are relatively poor flyers and are collected fairly easily with a sweep net.

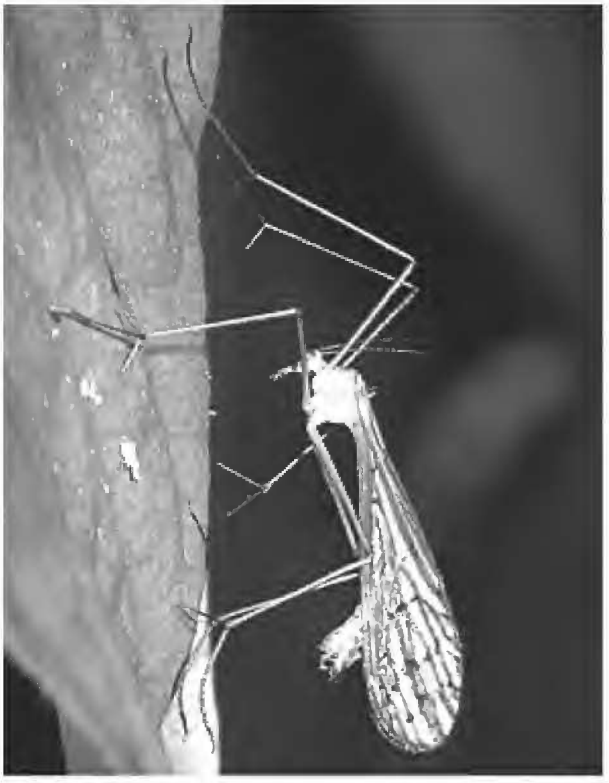

Fig. 12. The hangingfly *Bittacus strigosus* hanging characteristically from a leaf. ©2006, Joshua Jones.

Only one species, *Bittacus strigosus* Hagen, was collected during the event, including nine males and 29 females (Table 17). Collection sites included habitats with high forbs and low hanging hardwood branches along the Ford Mine Trail west of the parking lot (Fig. 13) and the lower branches of various hardwood trees and woody shrubs along the Valley Trail and Gold Mine Loop. Low leafy undergrowth in the latter two areas was largely non-existent, owing primarily to overgrazing by deer and a long history of disturbance (personal communication with park employees).

Most of the *B. strigosus* taken on 24 June were found on the northern bank of the Canal below the intersection of MacArthur Boulevard and Clara Barton Parkway northwest of Carderock. This area was devoid of trails and less impacted than other sites, and undergrowth was generally more dense.

The scorpionfly survey team consisted of team leader Joshua Jones, with some assistance by Alex Kim on 25 June. Jones contributed a total of 20 hours in the field (including preparation and travel time) and 10 hours on specimen preparation and identification (including data entry, report writing, specimen transfer to NPS) for a grand total of 30 hours (Table 25).

Table 17. Collection data for *Bittacus strigosus* obtained during the 2006 Potomac Gorge BioBlitz (all specimens from CHOH, MD).

COLLECTION SITE	NO. OF SPECIMENS
Ford Mine Trail, N side of C&O Canal	2 ♂♂, 2 ♀♀
Valley Trail, along trail	1 ♀
Gold Mine Loop, along trail	1 ♀
North bank of C&O Canal, below jct. of MacArthur Blvd. and Clara Barton Parkway west of Carderock	7 ♂♂, 21 ♀♀
Carderock: Billy Goat Trail Section C	4 ♀♀
Total specimens	9 ♂♂, 29 ♀♀

Beetles

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Beetles represent the most diverse group of animals in the Potomac Gorge. Yet, with the notable exception of Plummers Island (CHOH, MD) (Erwin, 1981; Staines, 2008a-f; Steiner, 2008), and a recent survey of leaf beetles and their allies (Cavey, 2006), no concerted effort has been made to document the beetle fauna of the region, save for Ulke's informative, yet long outdated list (1902) of the species known to occur in Washington, DC.

The Great Falls region of Virginia has been intensively surveyed by National Museum of Natural History and United States Department of Agriculture coleopterists for more than a century, but most of their records, along with new species descriptions, appear in widely scattered scientific journals. Much of the material collected in the region, including type specimens, is housed at the National Museum of Natural History, Smithsonian Institution.

Baited traps were rendered ineffectual by the overcast skies that allowed little sunlight to stimulate many of the larger day-flying species, and evening rains that deterred nocturnal species. The traps and their contents at both sites were removed on the morning of 24 June.

By far, collecting at blacklights and mercury vapor lights on the night of 23 June in Great Falls Park (GWMP, VA) was the single most productive method in terms of both species diversity and number of individuals. Two blacklight bucket traps were also productive.

Fig. 13. Site along the Ford Mine Trail, where a few specimens of *Bittacus strigosus* were collected. ©2006, Joshua Jones.

On 24 June, the beetle team split up into three groups. One team, led by A.V. Evans, concentrated on the trails and streams of Great Falls Park (GWMP, VA). The other team, led by W.E. Steiner, spent their field time on Bear Island (CHOH, MD). The last group, consisting of S. Lingafelter, J. Mawdsley, and N. Woodley, focused their efforts on Turkey Run Park (GWMP, VA).

Blooms of lizardtail (*Saururus cernuus* L.) and other plants were carefully examined and produced beetles of several families, including cantharids, cerambycids, mordellids, scarabs, and scraptiids, as well as other flower-visiting species. Beating vegetation resulted in the collection of anthribids, attelabids, buprestids, cerambycids, chrysomelids, coccinnellids, curculionids, elaterids, and scarabs, among others. Inspection of dead trees, logs, and stumps, especially those still covered with loose bark, and their associated fungi, yielded additional families and species.

Due to rapidly deteriorating weather conditions, all field collecting and trapping activities abruptly ceased on the afternoon of 24 June. The remainder of the time was spent processing specimens.

A total of 302 species of beetles was recorded during the BioBlitz (Table 18). Nineteen new state records were recorded for Virginia. Due to the lack of species lists for the parks, no attempt was made to verify any historical records. No species new to science are known to have been collected, nor were any globally or state rare species encountered. Several exotic species were found during the survey, all of which were known previously from the region.

The members of the Coleoptera survey team were Arthur V. Evans (team leader), Steve Lingafelter, Jonathan Mawdsley, Deblyn Mead, Warren Steiner, Jil Swearingen, Chris Wirth, and Norm Woodley. They contributed a combined total of 132 hours in the field (including travel time) and 229 hours on specimen preparation and identification (including data entry, report writing, and specimen transfer to NPS) for a grand total of 361 hours (Table 25).

Table 18. Beetles (Coleoptera) documented during the Potomac Gorge BioBlitz, 23-25 June 2006. GWMP=George Washington Memorial Parkway, VA (GF=Great Falls Park; TR=Turkey Run Park); CHOH=C & O Canal National Historical Park, MD (BI=Bear Island; CR=Carderock; GF=Great Falls Park; PI=Plummers Island; PI*= near Plummers Island). Species preceded by an asterisk (*) are new state records for Virginia.

FAMILY	SPECIES	GWMP		CHOH				
		GF	TR	BI	CR	GF	PI	PI*
Aderidae	*Aderus populneus* (Panzer)			X				
Anobiidae	Anobiidae sp. 1			X				
	Dorcatoma setulosa LeConte			X				
	Oligomerus alternans LeConte		X					
	Trichodesma klagesi Fall		X					
Anthicidae	*Anthicus cervinus* Laferte-Senectere	X						
	Ischyropalpus obscurus (LaFerté)			X				
	Macratia murina (Fabricius)	X						
	Notoxus muripennis (LeConte)	X						
	Stictocomus tobias (Marseul)	X						
Anthribidae	*Eurymycter fasciatus* (Olivier)		X					
	Ischnocerus infuscatus (Fahraeus)		X					
	Toxonotus cornutus (LeConte)	X	X					
Attelabidae	*Eugnamptus angustatus* (Herbst)		X					
Bostrichidae	*Lichenophanes bicornis* (Weber)	X	X	X				
Brentidae	*Arrenodes minutus* (Drury)		X					
Buprestidae	*Agrilus bilineatus* (Weber)	X	X					
	Agrilus obsoletoguttatus Gory		X					
	Agrilus ruficollis (Fabricius)	X						
	Anthaxia viridifrons Gory		X					
	Brachys aerosus Melsheimer			X				
	Pachyschelus laevigatus (Say)	X		X				
Byrrhidae	*Chaetophora spinosa* (Rossi)	X						
Cantharidae	*Chauliognathus marginatus* (Fabricius)			X				X
	Podabrus pygmaeus Green	X						
	Podabrus sp.							X
Carabidae	*Acupalpus indistinctus* Dejean			X				
	Acupalpus parvulus Dejean	X		X				
	Acupalpus testaceus Dejean	X						
	Agonum punctiforme (Say)		X					
	Amara aenea DeGeer	X						
	Amara familiaris Duftschmidt	X						
	Amphasia sericea (Harris)	X			X			
	Bembidion impotens Casey			X				
	Bembidion sp.	X						
	Carabidae sp. 1	X						
	Carabidae sp. 2		X					
	Carabidae sp. 3						X	
	Carabidae sp. 4			X				
	Carabidae sp. 5			X				
	Chlaenius aestivus Say	X	X					
	Chlaenius tricolor Dejean			X				
	Cicindela repanda Dejean			X				
	Cicindela sexguttata Fabricius	X						
	Clivina americana Dejean	X						
	Clivina bipustulata (Fabricius)	X		X				
	Clivina dentipes Dejean	X		X				
	Colliuris pensylvanicus (Linnaeus)	X						
	Dyschiriodes haemorroidalis (Dejean)	X		X				

Table 18 (continued).

FAMILY	SPECIES	GWMP		CHOH				
		GF	TR	BI	CR	GF	PI	PI*
Carabidae	*Elaphropus saturatus* Casey			X				
	Elaphropus xanthopus Dejean	X		X				
	Elaphrus californicus Mannerheim							
	Harpalus pensylvanicus (DeGeer)	X						
	Lebia grandis Hentz			X				
	Lebia lobulata LeConte	X						
	Lebia ornata Say	X						
	Lebia viridipennis Dejean	X						
	Lebia viridis Say	X						
	Notiophilus aeneus (Herbst)	X						
	Paratachys scitulus (LeConte)			X				
	Platynus cincticollis (Say)				X			
	Platynus opaculus LeConte		X					
	Poecilus lucublandus (Say)	X						
	Pterostichus coracinus (Newman)	X						
	Pterostichus ohionis Csiki	X						
	Scaphinotus vidnus (Dejean)	X						
	Scarites subterraneus (Fabricius)	X	X					
	Stenolophus lecontei (Chaudoir)	X		X				
	Stenolophus ochropezus (Say)	X	X	X				
	Tetragonoderus fasciatus (Haldeman)			X				
	Trichotichnus autumnalis (Say)	X						
	Trichotichnus dichrous Dejean	X						
Cerambycidae	*Astylopsis macula* (Say)		X					
	Ecyrus dasycerus (Say)		X					
	Elaphidion mucronatum (Say)	X	X					
	Eupogonius pauper (LeConte)		X					
	Eupogonius subarmatus (LeConte)		X					
	Hyperplatys aspersa (Say)	X	X					
	Leptura confluens (Haldeman)	X	X					
	Metacmaeops vittata (Swederus)		X					
	Oberea perspicillata Haldeman		X					
	Prionus imbricornis (Linnaeus)	X			X			
	Psenocerus supernotatus (Say)		X					
	Smodicum cucujiforme (Say)	X						
	Strangalepta abbreviata (Germar)	X						
	Strangalia famelica Newman	X						
	Strangalia luteicornis (Fabricius)	X	X				X	
	Tylonotus bimaculatus Haldeman	X						
	Typocerus velutinus (Olivier)	X	X					
	Urgleptes facetus (Say)	X	X					
	Urgleptes signatus (LeConte)	X	X					
	Urographis despectus (LeConte)		X					
	Urographis fasciatus (DeGeer)	X						
	Xylotrechus colonus (Fabricius)	X						
Cerylonidae	*Philothermus glabriculus* LeConte	X						
Chrysomelidae	*Altica chalybea* Illiger		X					
	Altica ignita Illiger	X						
	Baliosus nervosus (Panzer)		X					
	Bassareus mammifer (Newman)		X					
	Brachypnoea clypealis (Horn)	X		X				
	Chaetocnema truncata White	X						
	Chrysochus auratus (Fabricius)							X

Table 18 (continued).

FAMILY	SPECIES	GWMP		CHOH				
		GF	TR	BI	CR	GF	PI	PI*
Chrysomelidae	*Demotina modesta* Baly	X						
	Diabrotica undecimpunctata howardi Barber	X		X				
	Epitrix fuscula Crotch			X				
	Fidia longipes (Melsheimer)		X					
	Globobruchus mimus (Say)	X						
	Odontota dorsalis (Thunberg)	X	X					
	Odontota scapularis Olivier		X					
	Paria fragariae Wilcox	X						
	Paria quadrinotata (Say)	X						
	Paria sp.				X			
	Sumitrosis inaequalis (Weber)		X					
	Tymnes tricolor (Fabricius)	X	X					
Cleridae	*Cregya oculata* (Say)		X					
	Madoniella dislocatus (Say)		X					
Coccinellidae	*Chilocoris stigma* (Say)			X		X		
	Coccinella septempunctata (Linnaeus)	X		X				
	Coelomegilla maculata lengi Timberlake							X
	Diomus humilis Gordon	X						
	Diomus terminatus (Say)	X						
	Harmonia axyridis (Pallas)	X	X	X		X	X	X
	Hyperaspis sp.	X						
Cupedidae	*Tenomerga cinereus* Say	X						
Curculionidae	**Acalles carinatus* LeConte		X					
	**Acoptus suturalis* LeConte		X					
	**Anthonomous suturalis* LeConte	X						
	Aphrastus taeniatus Say	X	X	X				
	Calomycterus setarius Roelofs	X						
	**Cophes obtensus* (Herbst)		X					
	Cossonus impressifrons Boheman	X		X				
	**Cryptorhynchus tristis* LeConte	X						
	Eubulus bisignatus (Say)	X						
	Euplatypus compositus (Say)	X						
	**Listronotus humilis* Gyllenhal	X						
	Listronotus oregonensis (LeConte)						X	
	Myllocerus hilleri Faust	X						
	Myrmex myrmex (Herbst)	X						
	Perigaster cretura (Herbst)	X						
	Pseudocneorhinus bifasciatus (Roelofs)	X						
	Rhodobaenus quinquepunctatus (Weber)			X				
	Scolytinae sp.	X						
	Sphenophorus minimus Hart			X				
	Tychius picirostris (Fabricius)	X						
	Xyloborus celsus Eichhoff	X		X				
	Xyloborus ferrugineus (Fabricius)	X		X				
	Xyloborus pubescens Zimmerman			X				
	Xylosandrus crassiusculus (Motschulsky)	X		X				
Dermestidae	*Cryptorhopalus triste* LeConte	X						
Dytiscidae	*Neoporus striatopunctatus* (Melsheimer)	X						

Table 18 (continued).

FAMILY	SPECIES	GWMP		CHOH				
		GF	TR	BI	CR	GF	PI	PI*
Elateridae	**Aeolus scutellatus* (Schaeffer)	X						
	Alaus oculatus (Fabricius)	X						
	Conoderus bellus (Say)	X						
	Elateridae sp. 1			X				
	Elateridae sp. 2	X		X				
	Elateridae sp. 3			X			X	
	Elateridae sp. 4			X				
	Elateridae sp. 5	X		X	X			
	Elateridae sp. 12		X					
	Elateridae sp. 14	X		X				
	Hemicrepidus memnonius (Herbst)	X		X	X			
	Melanactes piceus DeGeer	X						
	**Neopristilophus aethiops* (Herbst)	X						
Elmidae	*Stenelmis bicarinata* LeConte	X						
	Stenelmis mera Sanderson	X						
Endomychidae	*Endomychus biguttatus* Say	X	X					
Erotylidae	*Acropteroxys gracilis* (Newman)			X				
	Ischyrus quadripunctatus (Olivier)			X			X	
	Megalodacne heros (Say)	X						
	Toramus pulchellus (LeConte)	X		X				
	Triplax flavicollis Lacordaire	X						
	Triplax thoracica (Say)	X						
Eucinetidae	*Eucinetus morio* LeConte			X				
Eucnemidae	**Dirrhagofarsus lewisi* (Fleutiaux)	X	X					
	Isorhipis ruficornis Say		X					
	**Stethon pectorosus* LeConte	X						
Haliplidae	*Peltodytes sexmaculatus* Roberts	X						
Heteroceridae	*Lanternarius mollinus* (Kiesenwetter)	X		X				
	Neoheterocerus longilobulus Pacheco	X						
	Tropicus pusillus (Say)			X				
Hybosoridae	*Germarostes globosus* (Say)			X				
Hydrophilidae	*Berosus perigrinus* (Herbst)	X		X				
	Enochrus ochraceus (Melsheimer)			X				
	Enochrus pygmaeus nebulosus (Say)			X				
	Helocombus bifidus (LeConte)			X				
	Hydrobius melaenus (Germar)	X					X	
	Hydrochara soror Smetana	X						
	Hydrochus sp. 1			X				
	Hydrochus sp. 2			X				
	Hydrophilus ovatus (Gemminger & Harold)	X						
	Tropistermus collaris striolatus (LeConte)						X	
	Tropistermus lateralis nimbatus (Say)	X	X					
Ithyceridae	*Ithycerus novaboracensis* (Forster)	X						
Lampyridae	*Lucidota atra* (Fabricius)		X	X				
	Photinus pyralis (Linnaeus)	X	X					
	Photuris lucicrescens Barber	X						
	Photuris pensylvanicus (DeGeer)	X						
Latridiidae	**Melanophthalma distinguenda* Comolli	X						
Leiodidae	*Prionochaeta opaca* (Say)		X					
Lucanidae	*Ceruchus piceus* (Weber)	X	X	X				
	Dorcus parallelus (Say)	X						

Table 18 (continued).

FAMILY	SPECIES	GWMP		CHOH				
		GF	TR	BI	CR	GF	PI	PI*
Lycidae	*Eros* sp.		X					
Melandryidae	*Dircaea liturata* (LeConte)	X		X				
	**Orchesia ovata* Laliberte	X						
Melyridae	*Collops tricolor* (Say)			X				
Mordellidae	*Falsomordellistena hebraica* (LeConte)	X	X					
	Falsomordellistena pubescens (Fabricius)	X						
	**Glipa hilaris* (Say)	X	X					
	Glipstenoda ambusta LeConte		X					
	Hoshihananomia octopuncta (Fabricius)	X	X					
	Mordella marginata Melsheimer	X						
	Mordellistena andrae LeConte	X						
	Mordellistena liturata Melsheimer	X						
	**Mordellistena ornata* (Melsheimer)		X					
	Mordellistena trifasciata (Say)			X				
	Paramoredellaria triloba (Say)	X						
	Pseudotolida arida (LeConte)	X						
	**Pseudotolida lutea* (Melsheimer)	X	X					
Mycetophagidae	*Mycetophagus punctatus* Say			X				
Nitidulidae	*Amphicrossus ciliatus* (Olivier)	X		X				
	Cryptarcha ampla Erichson	X		X				
	Epuraea rufa (Say)	X	X					
	Prometopia sexmaculata (Say)			X				
	Stelidota geminata (Say)		X					
Passalidae	*Odontotaenius disjunctus* (Illiger)	X	X	X				
Ptilodactylidae	*Ptilodactyla angustata* Horn	X						
	Ptilodactyla carinata Johnson & Freytag	X						
Pyrochroidae	*Neopyrochora flabellata* (Fabricius)	X	X					
Ripiphoridae	*Ripiphorus schwarzi* LeConte		X					
Scarabaeidae	*Blackburneus stercorosus* (Melsheimer)	X		X				
	Ataenius gracilis (Melsheimer)	X		X				
	Ataenius imbricatus (Melsheimer)	X						
	Ataenius simulator Harold	X						
	Calamosternus granarius (Linnaeus)	X		X				
	Cyclocephala borealis Arrow	X		X	X			
	Dichotomius carolinus (Linnaeus)	X						
	Diplotaxis frondicola (Say)				X			
	Diplotaxis liberta (Germar)	X						
	Exomala orientalis (Waterhouse)	X	X	X	X			
	Maladera castanea (Arrow)	X		X				
	Nipponoserica peregrina (Chapin)			X	X			
	Osmoderma scabra (Palisot de Beauvois)					X		
	Pelidnota punctata (Linnaeus)	X						
	Phyllophaga crenulata (Froelich)	X		X	X		X	
	Phyllophaga ephilida (Say)	X		X	X			
	Popillia japonica Newman	X		X				
	Serica atracapilla (Kirby)			X				
Scirtidae	*Cyphon obscurus* (Guerin)	X						
	Prionocyphon limbata LeConte			X				
Scraptiidae	*Anaspis rufa* Say	X	X					
Silphidae	*Necrophila americana* (Linnaeus)	X	X	X				
	Nicrophorus orbicollis Say	X	X					
	Nicrophorus tomentosus Weber	X						
	Oiceoptoma novaboracense (Forster)		X					

Table 18 (continued).

FAMILY	SPECIES	GWMP		CHOH				
		GF	TR	BI	CR	GF	PI	PI*
Silvanidae	**Cathartosilvanus imbellis* (LeConte)			X				
	Uleiota dubia (Fabricius)		X					
Staphylinidae	*Paederus* sp. 1			X				
	Paederus sp. 2	X						
	Pinophilus latipes Gravenhorst	X						
	Platydracus maculicollis (Gravenhorst)	X						
	Staphylinidae sp. 1			X				
	Staphylinidae sp. 2			X				
	Staphylinidae sp. 3		X	X				
	Tachinus fimbriatus (Gravenhorst)		X					
Synchroidae	*Synchroa punctata* Newman	X	X	X				
Tenebrionidae	*Alaetrinus minimus* (Palisot de Beauvois)			X				
	Alobates pennsylvanicus DeGeer	X						
	Arthromacra aenea Say		X					
	Centronopus calcaratus (Fabricius)			X				
	Eutochia picea Melsheimer			X				
	Gorginus rubens (LeConte)			X				
	Haplandrus fulvipes Herbst			X				
	Hymenorus obesus Casey			X				
	Hymenorus perforatus Say				X			
	Hymenorus pilosus Melsheimer			X				
	Isomira sericea (Say)	X						
	Lobopoda erythrocnemis (Germar)			X				
	Meracantha contracta Palisot de Beauvois	X	X	X				
	Merinus laevis (Olivier)		X					
	Neomida bicornis (Fabricius)	X		X				
	Platydema excavatum Say			X				
	Platydema ruficorne (Sturm)		X					
	Platydema subcostatum Laporte & Brulle	X	X					
	**Strongylium crenatum* Malkin	X	X					
	Strongylium temicollis (Say)				X			
	Strongylium terminatum (Say)	X						
	Uloma impressa Melsheimer		X					
	**Uloma mentalis* Horn	X		X				
	Xylopinus saperdoides (Olivier)	X		X				
Teratomidae	*Penthe obliquata* (Fabricius)	X						
	Penthe pimelia (Fabricius)			X				
	Synstrophus repandus (Horn)	X						
Throscidae	*Trixagus chevrolati* (Bonvouloir)			X				
Trogidae	*Trox spinulosus simi* Robinson	X						
Trogossitidae	*Tenebroides americanus* (Kirby)	X						
Zopheridae	**Eucicontes marginalis* (Melsheimer)			X				
Other Coleoptera	sp. 2	X		X				
	sp. 3	X						
	sp. 4	X						

Flies

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The first BioBlitz ever was held in 1996 (weekend of 31 May-1 June) at Kenilworth Gardens (Washington, DC). Dr. F. Christian Thompson led the Diptera group, which recorded 183 species of flies. This report concerns the Diptera (190 species; see Table 19) that were sampled as part of the Potomac Gorge BioBlitz held ten years later.

A survey of the true flies in the greater Washington, DC area was started early in the 20th century by local dipterists. This early survey resulted in a series of papers on the Diptera or true flies, beginning with Banks et al. (1916). These papers dealt with the Diptera fauna on a family basis, and the series was eventually intended to treat comprehensively all represented families. Only 17 families were then published, with the last appearing in 1931 (Malloch et al., 1931). Nearly 50 years later, Wirth and coauthors (Wirth et al., 1977; Wirth & Grogan 1979, 1981) published three faunistic papers on three tribes of the family Ceratopogonidae. Most recently, the Ephydridae of Plummers Island (CHOH) was reviewed by Mathis & Mathis (2008).

Although the BioBlitz is not a comprehensive family treatment, the resulting survey is part of a continuing effort to increase our knowledge of Diptera from this region.

Efforts were made to collect all families of flies during the sampling period, but the species collected during the BioBlitz somewhat reflects the biases of the collectors taking part in the survey. Thus Nematocera, or the lower Diptera, are not as well represented as some groups of higher Diptera. Comparatively well-sampled were the families Dolichopodidae, Ephydridae, and Syrphidae.

Because our knowledge of Diptera from the Mid-Atlantic states is generally meager, especially specific information on their distribution, abundance, and natural history, we are hesitant to list any species as rare. However, some of the sampled species are of particular interest because they are not generally collected including *Hyadina corona* (Cresson), *Scatophila carinata* Sturtevant & Wheeler (both Ephydridae), *Leptomorphus nebulosus* Walker (Mycetophilidae), and *Rachicerus obscuripennis* Loew (Xylophagidae).

The team collected on 24 June in Turkey Run and Great Falls parks (GWMP, VA). Severe weather that evening and the next day precluded any collecting in Maryland.

The success of short-term, rapid surveys, measured in terms of the number of species collected to that actually occurring at the site, is strongly influenced by seasonality and serendipity. In 2006, the shore flies (family Ephydridae) were sampled throughout the field season at Turkey Run and Great Falls parks, resulting in 61 species. On the single day of collecting for the BioBlitz at the same sites, we found 37 species, which was the greatest number of species sampled on a single day during 2006.

Participants (collectors and identifiers [I=identifier only]) included Paul Bedell, Irina Brake, Stephen D. Gaimari (I), Jon K. Gelhaus (I), Graham C. D. Griffiths (I), Lloyd V. Knutson (I), Stephen A. Marshall (I), Wayne N. Mathis, Allen L. Norrbom, Gary D. Ouellette, Justin B. Runyon (I), Aubrey G. Scarbrough (I), Betty Thompson, F. Christian Thompson, Terry A. Wheeler (I), Hollis B. Williams, Norman E. Woodley, and Tadeusz F. Zatwarnicki. The Diptera team spent a combined total of 140 hours in the field, 24 hours on specimen preparation (including data entry, report writing, and specimen transfer to NPS), and 168 hours on specimen identification for a total of 332 hours (Table 25).

Table 19. Flies (Diptera) documented during the Potomac Gorge BioBlitz, 23-25 June 2006. GWMP=George Washington Memorial Parkway, VA (GF=Great Falls Park; TR=Turkey Run Park); CHOH=C & O Canal National Historical Park, MD (CR=Carderock; PI=Plummers Island); GE=Glen Echo Park (GWMP, MD).

FAMILY	SPECIES	GWMP		CHOH		GE
		GF	TR	CR	PI	
Anthymyiidae	*Delia platura* (Meigen)		X			
	Eustalomyia vittipes (Zetterstedt)	X				
	Eutrichota lipsia (Walker)	X				
	Hylemyia partita (Meigen)	X	X			
	Zaphne uniformis (Malloch)		X			
	Anthymyiidae sp. 3	X				
	Anthymyiidae sp. 7		X			
Asilidae	*Endioctria tibialis* (Banks)	X				
	Laphria canis Williston	X			X	
	Laphria flavicollis Say		X			
	Laphria ithypyga McAtee	X				
	Laphria sicula McAtee		X			
	Laphria thoracica Fabricius		X			
	Machimus notatus (Wiedemann)	X				
	Neoitamus flavofemoratus (Hine)		X			
	Philonicus fuscatus (Hine)	X			X	
Bombyliidae	*Anthrax argyropygus* (Wiedemann)	X				
Calliphoridae	*Lucilia coeruleiviridis* Macquart	X				
	Lucilia illustris (Meigen)		X			X
	Phormia regina Meigen	X				
	Pollenia labialis Robineau-Desvoidy	X	X			
Ceratopogonidae	Ceratopogonidae sp.	X	X			
Chloropidae	*Apallates caxerdix* (Fitch)		X			
	Apotropina hirtaides (Sabrosky)		X			
	Chlorops sp. 2		X			
	Elachiptera eulopha (Coquillett)	X				
	Elachiptera nr. *angustifrons* Sabrosky					X
Culicidae	Culicidae sp.	X	X			X
Dolichopodidae	*Argyra flavipes* Van Duzee		X			
	Chrysotus philtrum Melander	X				
	Chrysotus picticornis Loew		X			X
	Chrysotus sp. 1		X			
	Chrysotus sp.2	X				
	Condylostylus scaber (Loew)		X			
	Condylostylus sipho (Say)		X			
	Dolichopus longipennis Loew	X				
	Dolichopus tonsus Loew	X	X			
	Gymnoptermus flavus Loew		X			
	Gymnoptermus humilis Loew	X				
	Gymnoptermus meniscus Loew		X			
	Gymnoptermus opacus Loew		X			
	Gymnoptermus politus Loew	X	X			
	Gymnoptermus pseudodebilis Robinson	X				
	Gymnoptermus sp.		X			
	Micromorphus sp.	X				
	Pelastoneurus sp.	X				

Table 19 (continued).

FAMILY	SPECIES	GWMP		CHOH		GE
		GF	TR	CR	PI	
Dolichopodidae	*Peloropeodes* sp. 1	X				
	Peloropeodes sp. 2	X				
	Peloropeodes sp. 3	X				
	Rhaphium exile Curran	X				
	Sympycnus lineatus Loew	X				
	Thrypticus muhlenbergiae Johannsen & Crosby	X				
Drosophilidae	*Amiota minor* Malloch		X			
	Chmomyza amoena (Loew)		X			
	Scaptomyza adusta (Loew)	X				
	Scaptomyza pallida (Zetterstedt)	X				
Empididae	*Hemerodromia superstitiosa* Say		X			
	Platypalpus sp.		X			
Ephydridae	*Allotrichoma atrilabre* Cresson		X			
	Allotrichoma simplex (Loew)	X	X			
	Athyroglossa dinorata Mathis and Zatwarnicki	X	X			
	Athyroglossa glaphyropus Loew		X			
	Axysta bradleyi Cresson	X				
	Brachydeutera argentata (Walker)		X			
	Diclasiopa lacteipennis (Loew)	X	X			
	Discocerina obscura Williston	X				
	Discocerina obscurella (Fallén)	X	X			
	Ditrichophora exigua Cresson		X			
	Gastrops nebulosus Coquillett		X			
	Hecamedoides unispinosus (Collin)	X	X			
	Hyadina binotata (Cresson)	X				
	Hyadina corona (Cresson)	X				
	Hydrellia sp. possibly new	X				
	Hydrellia formosa Loew	X				
	Hydrellia griseola (Fallén)	X				
	Hydrellia tibialis Walker	X				
	Hydrochasma leucoproctum (Loew)	X	X			
	Hydrochasma sp. C		X			
	Ilythea spilota (Curtis)	X				
	Nostima picta (Fallén)	X				
	Notiphila carinata Cresson		X			
	Notiphila scalaris Loew	X				
	Notiphila solita Walker	X				
	Paralimna punctipennis (Wiedemann)	X				
	Parydra breviceps Loew		X			
	Parydra quadrituberculata Loew	X				
	Parydra unituberculata Loew	X				
	Polytrichophora orbitalis (Loew)		X			
	Psilopa dupla Cresson		X			
	Scatella obsoleta Loew		X			
	Scatella picea (Walker)		X			
	Scatella tenuicosta Collin		X			
	Scatophila carinata Sturtevant & Wheeler	X				
	Scatophila variabilis Cresson	X	X			

Table 19 (continued).

FAMILY	SPECIES	GWMP		CHOH		GE
		GF	TR	CR	PI	
Ephydridae	*Zeros flavipes* (Williston)	X	X			
Keroplatidae	Keroplatidae sp.	X				
Lauxaniidae	*Camptoprosopella confusa* Shewell		X			
	Homoneura fuscibasis (Malloch)		X			
	Homoneura littoralis (Malloch)	X				
	Homoneura sp.		X			
	Minettia magna Coquillett	X	X			
	Neogriphoneura sordida (Wiedemann)		X			
	Poecilolycia n.sp. nr. *aspinosa*		X			
	Steganolauxania fascialis (Coquillett)	X				
Limoniidae	*Epiphragma solatrix* (Osten Sacken)	X				
	Eugnophomyia luctuosa (Osten Sacken)	X				
	Gnophomyia tristissima (Osten Sacken)	X				
	Limnophila macrocera (Say)	X				
	Pilaria recondite (Osten Sacken)	X				
	Pseudolimnophila contempta (Osten Sacken)	X				
	Teucholabis immaculata Alexander	X				
	Teucholabis sp.			X		
Lonchopteridae	*Lonchoptera bifurcata* (Fallén)		X			
Micropezidae	*Rainieria antennidepes* (Say)	X	X			
	Taeniaptera trivittata Macquart		X			
Muscidae	*Coenosia* sp.		X			
	Hebecnema nigra (Rob.-Des.)		X			
	Helina sp.	X				
	Limnophora narona (Walker)		X			
	Limnophora sp.		X			
	Lispe sociabilis Loew		X			
	Schoenomyza chrysostoma Loew	X	X			
Mycetophilidae	*Leptomorphus nebulosus* Walker		X			
	Mycetophila bipunctata Loew		X			
Platystomatidae	*Rivellia* sp.		X			
Phoridae	Phoridae sp.	X				
	Megaselia scalaris Loew		X			
Pipunculidae	*Chalarus spureous* Fallen		X			
	Eudorylas tarsalis (Banks)					X
	Nephrocerus atrepilus Skevington		X			
Psilidae	*Loxocera cylindrical* Say	X				
Ptychopteridae	*Bittacomorpha clavipes* (Fabricius)	X				
	Ptychoptera rufocincta Osten Sacken	X				
Pyrgotidae	*Spheconyia valida* Harris				X	
Rhagionidae	*Chrysopilus fasciatus* (Say)	X				
	Chrysopilus modestus Loew	X	X			X
	Chrysopilus quadratus (Say)	X				
	Chrysopilus rotundipennis Loew	X				
Sarcophagidae	*Metopia argyrocephala* (Meigen)	X	X			
	Helicobia rapax (Walker)		X			
	Ravinia stimulans (Walker)	X				
Sciomyzidae	*Atrichomelina pubera* (Loew)		X			

Table 19 (continued).

FAMILY	SPECIES	GWMP		CHOH		GE
		GF	TR	CR	PI	
Sciomyzidae	*Dictya brimleyi* Steyskal		X			
	Dictya texana Curran	X	X			
	Dictya sp. (female)					X
	Pherbellia nana (Fallén)	X	X			X
	Pherbellia parallela (Walker)		X			
	Sepedon armipes (Loew)	X	X			
	Sepedon floridensis Steyskal	X	X			
Sepsidae	*Sepsis punctum* Fabricius	X				
Sphaeroceridae	*Leptocera* sp.					X
	Rachispoda sp.					X
Stratiomyidae	*Ptecticus trivittatus* (Say)	X				
	Sargus elegans Loew	X				
Syrphidae	*Allograpta obliqua* (Say)					X
	Chalcosyrphus metallicus (Wiedemann)	X				
	Copestylum vesicularium (Curran)		X			
	Eumerus funeralis Meigen					X
	Eupeodes americanus (Wiedemann)		X			X
	Ocyptamus fuscipennis (Say)		X			
	Platycheirus obscurus (Say)		X			
	Sphegina campanulata Robertson		X			
	Sphegina keeniana Williston		X			
	Syritta pipiens (Linnaeus)					X
	Syrphus rectus Osten Sacken	X	X		X	
	Syrphus ribesii (Linnaeus)		X			
	Temnostoma trifasciatum Robertson	X				
	Toxomerus geminatus (Say)	X	X			X
	Toxomerus marginatus (Say)		X			
	Xylota n. sp. 78-3 Thompson	X	X			
Tachinidae	*Blondelia hyphantriae* (Tothill)	X	X			
	Cordyligaster septentrionalis Townsend		X			
	Eucelatoria texana (Reinhard)		X			
	Leschenaultia reinhardi Toma & Grimaraes		X			
	Lespesia sp.		X			
	Mystacella chrysoprocta (Wiedemann)	X				
	Neomintho celeris (Townsend)		X			
	Siphona flavipes (Coquillett)		X			
	Winthemia rufopicta (Bigot)	X				
Tipulidae	*Dolichopeza carolus* Alexander	X				
	Nephrotoma eucera (Loew)	X		X		
	Nephrotoma macrocera (Say)	X				
	Tipula concava Alexander		X		X	
	Tipula duplex Walker	X				
	Tipula eluta Loew			X	X	
	Tipula eucera (Loew)	X				
	Tipula flavoumbrosa Alexander	X	X			
	Tipula submaculata Loew	X				
	Tipula n. sp.	X				
Xylophagidae	*Rachicerus obscuripennis* Loew	X				

Moths and butterflies

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The vast majority of the species and specimens were moths collected in blacklight traps at night, while the diurnal surveys provided observations of several butterfly species. The documented species were all common and widespread in the region (see also Steury et al., 2007; Brown et al., 2008; Pogue, 2008; Solis, 2008; Vann, 2008). No state or federally listed endangered or threatened species or species of special concern were observed. As would be expected, Noctuidae (57 species) was the dominant family in the traps. Nearly all blacklight traps included males of the gypsy moth (*Lymantria dispar* [Linnaeus]), the females of which are diurnal and rarely taken in blacklight traps. This species was abundant on Plummers Island during the diurnal surveys on 24 June. A total of 185 species (ca. 500 individuals) in 28 families of Lepidoptera was documented (Table 20) during the BioBlitz.

The members of the team were John Brown (team leader), Dave Adamski, Don and Mignon Davis, Cristina Francois, Stan Hopkins, Lisa Kaltenberger, Jon Lewis, Eric Lind, Robert Lyon, Becca Phillips, Michael Pogue, Anne Pogue, Matthew Southy, and Kimberly Vann. They contributed a combined total of 30 hours in the field (including travel time) and 200 hours on specimen preparation (Fig. 14) and identification (including data entry, report writing, specimen transfer to NPS) for a grand total of 230 hours (Table 25).

Fig. 14. Moth vouchers in the process of being sorted and segregated to morphospecies by volunteer surveyors. Most of the moths captured during the BioBlitz were collected in blacklight traps. ©2006, Mark Godfrey.

Ants and bees

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Previous surveys of the Hymenoptera in the Potomac Gorge are largely limited to the works of Karl Krombein, who published numerous books and papers that included his bee data from Plummers Island (CHOH, MD) (see Norden, 2008).

Forty-eight species of bees were found during the BioBlitz. Some species of *Lasioglossum* and *Sphecodes* have been sent to specialists where they await identification upon the completion of monographic revisions. It is notable that while there was a fair amount of fringed loosestrife (*Lysimachia ciliata* Linnaeus) blooming along the river, no species of *Macropis* were collected; three species in this genus were recorded in the region during the early part of the last century.

Dan Kjar identified 17 species of ants following a general inspection of ant residue submitted from several survey teams. In most cases, no specimens were preserved. All are common and expected species. One of the exotic species encountered, *Vollenhovia emeryi* Wheeler from Asia, is known in the United States only from populations in Philadelphia and the Washington, DC area (Kjar & Suman, 2007). The other exotic ant species encountered are cosmopolitan, or nearly so, and their occurrence in the Potomac Gorge is not notable.

Wasps were not determined to species during this study. Twenty-nine morphospecies were collected, but vouchers were not retained nor were collection records kept; these morphospecies are not included in the total species number.

The ant and bee team recorded a total of 65 species during the BioBlitz (Table 21). The members of the survey team were Sam Droege (team leader), Jesse Duff-Woodruff, Beth Johnson, Hormuzd Katki, Dan Kjar, John Pascarella, Eric Soderholm, Craig Tufts, and David Ziolkowski; Brent Steury of the NPS (GWMP, VA) also contributed samples to the survey. The team contributed a combined total of 62 hours in the field (including travel time) and 26 hours on specimen preparation and identification (including data entry, report writing, specimen transfer to NPS) for a grand total of 88 hours (Table 25).

Table 20. Moths and butterflies (Lepidoptera) documented during the Potomac Gorge BioBlitz, 23-25 June 2006. GWMP=George Washington Memorial Parkway, VA (GF=Great Falls Park; TR=Turkey Run Park); CHOH=C & O Canal National Historical Park, MD (BI=Bear Island; CO=Lock 11; CR=Carderock; PI=Plummers Island; PI*= near Plummers Island).

FAMILY	SPECIES	GWMP		CHOH				
		GF	TR	BI	CO	CR	PI	PI*
Acrolophidae	*Acrolophus arcanella* (Clemens)	X				X		
	Acrolophus panamae Busck	X				X		
	Acrolophus plumifrontella (Clemens)	X				X		
	Amydria n. sp.	X						
Apatelodidae	*Olceclostera angelica* (Grote)		X					
Arctiidae	*Ecpantheria scribonia* (Stoll)	X						
	Enchaetes egle (Drury)		X	X				
	Halysidota tessallaris (J. E. Smith)	X	X			X	X	
	Haploa clymene (Brown)	X					X	
	Hyphantria cunea (Drury)			X				
	Hypoprepia fucosa Huebner	X	X					
	Lycomorpha pholus (Drury)	X						
	Spilosoma latipennis Stretch		X					
	Spilosoma virginica (Fabricius)	X	X					
Cossidae	*Prionoxystus robiniae* (Peck)	X						
Crambidae	*Crambus agitatellus* Clemens	X	X					
	Fissicrambus mutabilis Clemens						X	
	Neodactria luteolella (Clemens)						X	
	Parapoynx obscuralis (Grote)						X	
	Petrophila bifascialis (Robinson)	X					X	
	Petrophila fulicalis (Clemens)						X	
	Crambidae sp.			X				
Epiplemidae	*Callizzia amorata* Packard		X					
Geometridae	*Costaconvexa centrostrigaria* (Wollaston)		X					
	Cyclophora packardi (Prout)		X					
	Cyclophora pendulinaria (Guenée)	X						
	Digrammia ocellinata (Guenée)	X	X					
	Ectropis crepuscularia (Denis & Schiffermueller)		X					
	Epimecis hortaria (Fabricius)		X				X	
	Eulithis diversilineata (Huebner)		X					
	Euphyia mangulata (Haworth)		X					
	Eusarca confusaria Huebner		X					
	Eutrapela clemataria (J. E. Smith)	X	X				X	
	Itame pustularia (Guenée)	X	X				X	
	Macaria aemulatria (Walker)	X	X				X	
	Melanolophia canadaria (Guenée)		X					
	Metarranthis angularia Barnes & McDunnough		X					
	Nemoria bistriaria Huebner		X					
	Orthonama obstipata (Fabricius)		X				X	
	Patalene olyzonaria (Walker)		X					
	Prochoerodes transversata (Drury)	X						
	Scopula limboundata (Haworth)	X	X				X	
	Thysanopyga intractata (Walker)		X					
Gracillariidae	*Cameraria guttifinitella* (Clemens)					X		
	Cameraria (or *Phyllonorycter*) *ostryaefoliella* (Clemens)					X		
	Cameraria sp.	X						
	Chrysaster ostensackenella (Fitch)					X		
	Parectopa robiniella Clemens					X		

Table 20 (continued).

FAMILY	SPECIES	GWMP		CHOH				
		GF	TR	BI	CO	CR	PI	PI*
Gracillariidae	*Phyllocnistis vitegenella* Clemens					X		
	Phyllonorycter crataegella (Clemens)					X		
	Phyllonorycter sp.	X						
Hesperiidae	*Epargyreus clarus* (Cramer)						X	
	Poanes zabulon (Boisduval & LeConte)						X	
	Pompeius verna (Edwards)						X	
Limacodidae	*Acharia stimulea* (Clemens)					X		
	Apoda y-inversum (Packard)		X					
	Euclea delphinii (Boisduval)	X	X			X		
	Lithacodes fasciola (Herrich-Schaeffer)		X	X		X	X	
	Natada nasoni (Grote)	X	X			X		
	Parasa chloris (Herrich-Schaeffer)	X						
	Parasa indetermina (Boisduval)					X		
Lycaenidae	*Celastrina ladon* (Cramer)				X			
	Everes comyntas (Godart)	X						
Lymantriidae	*Dasychira basiflava* (Packard)					X		
	Dasychira obliquata (Grote & Robinson)	X						
	Dasychira tephra Huebner		X					
	Lymantria dispar (Linnaeus)		X	X		X	X	
	Orgyia definita Packard		X			X		
Megalopygidae	*Lagoa crispata* (Packard)	X				X		
Mimallonidae	*Lacosoma chiridota* Grote	X						
Nepticulidae	*Stigmella* sp. 1	X						
	Stigmella sp. 2	X						
Noctuidae	*Acronicta americana* (Harris)		X					
	Acronicta haesitata (Grote)		X	X		X		
	Acronicta increta Morrison			X				
	Acronicta laetifica Smith					X		
	Agrotis ipsilon (Hufnagel)		X				X	
	Allotria elonympha (Huebner)		X	X		X		
	Amphipoea velata (Walker)		X					
	Autographa precationis (Guenée)					X		
	Azenia obtusa (Herrich-Schaeffer)	X					X	
	Baileya dormitans (Guenée)		X					
	Baileya ophthalmica (Guenée)					X		
	Bellura densa (Walker)						X	
	Bomolocha baltimoralis (Guenée)		X					
	Caenurgina crassiuscula (Haworth)			X				
	Catocala ilia (Cramer)					X		
	Condica vecors (Guenée)		X			X		
	Eudryas grata (Fabricius)	X	X	X				
	Galgula partita Guenée		X					
	Hypena madefactalis (Guenée)		X					
	Hypena scabra (Fabricius)					X		
	Hyposoropha hormos Huebner			X				
	Idia aemula Huebner		X					
	Idia americalis (Guenée)		X			X		
	Idia lubricalis (Geyer)		X	X		X		
	Idia rotundalis (Walker)			X		X		
	Idia scobialis (Grote)					X		
	Iodopepla u-album (Guenée)			X				
	Lacinipolia renigera (Stephens)		X					

Table 20 (continued).

FAMILY	SPECIES	GWMP		CHOH				
		GF	TR	BI	CO	CR	PI	PI*
Noctuidae	*Ledaea perditalis* (Walker)			X			X	
	Lithacodia carneola (Guenée)						X	
	Lithacodia musta (Grote & Robinson)						X	
	Marathyssa inficita (Walker)			X				
	Metalectra discalis (Grote)		X					
	Metalectra quadrisignata (Walker)					X		
	Mythimna unipuncta Haworth		X					
	Noctua pronuba Linnaeus		X			X		
	Orthodes cynica Guenée		X	X				
	Orzaba aeria (Grote)					X	X	X
	Paectes oculatrix (Guenée)	X	X					
	Palthis asopialis (Guenée)		X					
	Panopoda carneicosta Guenée	X		X		X		
	Panopoda rufimargo (Huebner)	X	X					
	Parallelia bistriaris Huebner		X			X		
	Phalaenophana pyramusalis (Walker)		X					
	Phosphila miselioides (Guenée)	X						
	Polygrammate hebraeicum Huebner	X	X					
	Pseudeustrotia carneola (Guenée)							X
	Renia adspergilis (Bosc)		X					
	Scolecocampa liburna (Geyer)		X	X				X
	Spargaloma sexpunctata Grote		X	X		X		
	Thioptera nigrofimbria (Guenée)					X		
	Xestia dolosa Franclemont		X					
	Zale galbanata (Morrison)		X	X				
	Zanclognatha cruralis (Guenée)		X					
Notodontidae	*Datana angusii* Grote & Robinson	X	X	X		X		
	Datana drexelli (H. Edwards)						X	
	Ellida caniplaga (Walker)		X					
	Heterocampa obliqua Packard	X	X	X		X		
	Heterocampa sp.	X						
	Hyparpax aurora (J. E. Smith)	X						
	Lochmaeus bilineata (Packard)		X					
	Macrurocampa marthesia (Cramer)		X			X		
	Nadata gibbosa (J. E. Smith)		X	X		X		
	Nerice bidentata Walker			X				
	Oligocentria lignicolor (Walker)		X			X		
	Schizura ipomoeae Doubleday		X					
Nymphalidae	*Asterocampa celtis* (Boisduval & LeConte)						X	
	Megisto cymela (Cramer)	X						
	Phyciodes tharos (Drury)	X					X	
Oecophoridae	*Agonopterix robinella* (Packard)			X				
	Antaeotricha sp.	X						
	Martyringa latipennis (Walsingham)			X				
Papilionidae	*Eurytides marcellus* (Cramer)						X	
	Papilio glaucus Linnaeus	X					X	
	Papilio polyxenes Fabricius						X	
	Papilio troilus Linnaeus						X	
Pieridae	*Pieris rapae* (Linnaeus)	X					X	
Psychidae	*Psyche casta* (Pallas)					X		
Pterophoridae	*Emmelina monodactyla* (Linnaeus)						X	

Table 20 (continued).

FAMILY	SPECIES	GWMP		CHOH				
		GF	TR	BI	CO	CR	PI	PI*
Pyralidae	*Aglossa caprealis* (Huebner)	X	X					
	Conchylodes ovulalis (Guenée)						X	
	Desmia funeralis (Huebner)		X					
	Epipaschia superatalis Clemens					X		
	Herpetogramma pertextalis (Lederer)	X						
	Hypsopygia olinalis (Guenée)							X
	Ostrinia obumbratalis (Lederer)						X	
	Palpita magniferalis (Walker)		X					
	Pantographa limata (Grote & Robinson)		X					
	Pococera aplastella (Hulst)		X					
	Tosale oviplagalis (Walker)		X					
	Udea rubigalis (Guenée)		X				X	
Saturniidae	*Automeris io* (Fabricius)	X	X			X		
	Callosamia angulifera (Walker)		X					
	Dryocampa rubicunda (Fabricius)	X	X					
Sphingidae	*Amorpha juglandis* (Smith)		X					
	Ceratomia catalpae (Boisduval)						X	
Tineidae	*Kearfottia albifasciella* Fernald							X
	Mea skinnerella (Dietz)					X		
	Tinea pellionella Linnaeus		X					
	Xylesthia sp.		X				X	
Tortricidae	*Aethes angustana* Clemens						X	
	Argyrotaenia velutinana (Walker)						X	
	Choristoneura parallelana Walsingham			X				
	Endothenia hebesana (Walker)		X			X	X	
	Episimus argutanus (Clemens)		X					
	Eucosma sp.	X						
	Olethreutes fasciatana (Clemens)				X			
	Olethreutes sp.					X		
	Phaecasiophora confixana (Walker)		X					
	Platynota idaeusalis (Walker)						X	
	Proteoteras crescentana Kearfott	X						
	Sonia constrictana (Zeller)		X					

Table 21. Ants and bees (Order Hymenoptera) documented during the Potomac Gorge BioBlitz, 23-25 June 2006. GWMP=George Washington Memorial Parkway, VA (GF=Great Falls Park; TR=Turkey Run Park); CHOH=C & O Canal National Historical Park, MD (CB=Chain Bridge Flats; GF=Great Falls Park; PI=Potomac River, south of Plummers Island); GE=Glen Echo Park (GWMP, MD).

FAMILY	SPECIES	GWMP		CHOH			GE
		GF	TR	CB	GF	PI	
Andrenidae	*Andrena* (*Gonandrena*) *fragilis* Smith			X			
Apidae	*Apis* (*Apis*) *mellifera* Linnaeus		X		X		
	Bombus (*Pyrobombus*) *bimaculatus* Cresson				X		
	Bombus (*Pyrobombus*) *impatiens* Cresson			X	X		
	Bombus (*Pyrobombus*) *perplexus* Cresson	X	X		X	X	
	Bombus (*Pyrobombus*) *vagans* Smith ?					X	
	Bombus (*Separatobombus*) *griseocollis* (DeGeer)			X	X	X	
	Ceratina (*Zadontomerus*) *calcarata* Robertson			X	X		
	Ceratina (*Zadontomerus*) *dupla* Say			X			
	Ceratina (*Zadontomerus*) *strenua* Smith			X			
	Melitoma taurea (Say)			X		X	
	Xylocopa (*Xylocopoides*) *virginica* (Linnaeus)			X			
Chrysididae	Chrysididae sp.			X			
Colletidae	*Colletes latitarsis* Robertson					X	
	Hylaeus (*Hylaeus*) *leptocephalus* (Morawitz)			X			
	Hylaeus (*Hylaeus*) *mesillae* (Cockerell)			X			
	Hylaeus (*Prosopis*) *modestus* Say	X		X		X	
Formicidae	*Aphaenogaster fulva* Roger		X				X
	Aphaenogaster rudis Enzmann		X				X
	Aphaenogaster tennesseensis (Mayr)		X				X
	Camponotus castaneus (Latreille)		X				X
	Camponotus ferrugineus (Fabricius)		X				X
	Camponotus pennsylvanicus (De Geer)		X				X
	Camponotus subbarbatus Emery		X				X
	Crematogaster lineolata (Say)		X				X
	Leptothorax sp.		X				X
	Monomorium minimum (Buckley)		X				X
	Paratrechina faisonensis (Forel)		X				X
	Paratrechina flavipes (Smith)		X				X
	Ponera pennsylvanica Buckley		X				X
	Prenolepis imparis (Emery)		X				X
	Tapinoma sessile (Say)		X				X
	Tetramorium caespitum (Linnaeus)		X				X
	Vollenhovia emeryi Wheeler						X
Halictidae	*Agapostemon* (*Agapostemon*) *virescens* (Fabricius)				X		
	Augochlora (*Augochlora*) *pura* (Say)	X	X	X		X	
	Augochlorella aurata (Smith)			X	X	X	
	Halictus (*Odontalictus*) *ligatus* Say			X			
	Halictus (*Odontalictus*) *ligatus/poeyi*				X		
	Lasioglossum (*Dialictus*) *abanci* (Crawford)			X			
	Lasioglossum (*Dialictus*) *admirandum* (Sandhouse)			X			
	Lasioglossum (*Dialictus*) *bruneri* (Crawford)			X			
	Lasioglossum (*Dialictus*) *coeruleum* (Robertson)					X	
	Lasioglossum (*Dialictus*) *divergens* (Lovell)					X	
	Lasioglossum (*Dialictus*) *imitatum* (Smith)			X		X	
	Lasioglossum (*Dialictus*) *laevissimum* (Smith)			X			
	Lasioglossum (*Dialictus*) *oblongum* (Lovell)	X			X	X	
	Lasioglossum (*Dialictus*) *pilosum* (Smith)			X			
	Lasioglossum (*Dialictus*) *rohweri* (Ellis)			X			
	Lasioglossum (*Dialictus*) *tegulare* (Robertson)	X		X			

Table 21 (continued).

FAMILY	SPECIES	GWMP		CHOH			GE
		GF	TR	CB	GF	PI	
Halictidae	*Lasioglossum* (*Dialictus*) *zephyrum* (Smith)			X			
	Lasioglossum sp. 1			X		X	
	Lasioglossum sp. 2			X			
	Lasioglossum sp. nr. *cattaleae*					X	
	Lasioglossum sp. nr. *oblongum*	X					
	Sphecodes sp.			X			
Megachilidae	*Anthidiellum* (*Loyolanthidium*) *notatum* (Latreille)	X					
	Anthidium (*Proanthidium*) *oblongatum* (Illiger)	X					
	Coelioxys (*Boreocoelioxys*) *sayi* Robertson	X					
	Heriades (*Neotrypetes*) *carinatus* Cresson	X					
	Megachile (*Chelostomoides*) *exilis* Cresson			X			
	Megachile (*Eutricharaea*) *rotundata* (Fabricius)			X			
	Megachile (*Litomegachile*) *brevis* Say			X			
	Megachile (*Litomegachile*) *mendica* Cresson			X	X	X	
	Osmia (*Melanosmia*) *pumila* Cresson			X			

Amphibians and reptiles

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The Virginia Herpetological Society fielded a team to survey amphibians and reptiles during the BioBlitz. Eight sites were surveyed in both the GWMP (VA) and CHOH (MD), as described below. GPS readings (NAD83/ WGS84) were taken in the center of each site.

Great Falls Park, GWMP, VA

Site 1. Clay Pond. A small, semi-wooded pond with deep silty sediments. Many fallen logs provide basking sites for turtles. This pond is located in the northern portion of the Park. (18 304556E 4319334N)

Site 2. Trails by Patowmack Canal. This site consists of a series of trails paralleling the canal and the Potomac River. Beside the trail is a mature hardwood forest. At the end of the trail was a seepage area with a little standing water. (18 304600E 4319631N)

Site 3. Potomac River, northern portion. Three turtle traps were placed here. This portion of the river is braided with several side channels. (18 304678E 4319407N)

Site 4. Trails adjacent to Matildaville. This site consists of a small steam, trash pile, ruins of an old house, and a mature hardwood forest. (18 305018E 4318258N)

Turkey Run Park, GWMP, VA

Site 5. Trails and ephemeral stream. The portion of Turkey Run Park surveyed was the wooded debris piled around the bathrooms and park headquarters and a section of mature hardwood forest on the most eastern side of the park. (18 314047E 4314733N)

CHOH, MD

Site 6. Carroll Branch, small stream near Great Falls Tavern Visitor Center. This site contains a small stream in a mature hardwood forest. At the time of the survey the stream was rapidly rising due to the heavy rainstorms. The streambed is lined with cobble, sand, logs, and the sides were filled with leaf litter. (18 305542E 4319346N)

Site 7. Olmsted Island. This island was accessed via a wooded boardwalk and special permission was granted to our group to survey off the boardwalk. During flood periods parts of this island are submerged by the Potomac River. The island has few trees, but abundant grasses and other small herbaceous plants. Large granitic rock formations, some containing vernal pools, are visible all over the island. (18 305115E 4319140N)

Site 8. Bear Island. This large island, formed by a canal on the north and the Potomac River on the south, has many woodland ponds and vernal pools, as well as hardwood forests. Previously, disease surveys conducted on Bear Island revealed the presence of *Batrochytrium dendrobatidis* (chytrid fungus) and ranaviral infections (Mary Travaglini, DC/MD TNC, pers. comm.). Extra disinfection precautions were taken when surveying this area. (18 306428E 4317111N)

Three types of parasites (leech, mite, and tick) were observed on a turtle (coordinator's note: none of these are included in the final species count for the BioBlitz) and some of the captured lizards. Bear Island (CHOH, MD) contained the greatest biodiversity of species, whereas Olmsted Island produced the fewest (Table 22). Only native species were found during the survey.

Table 22. Summary of the number of amphibians and reptiles observed at survey sites 1-8.

Site	1	2	3	4	5	6	7	8	Misc*
Amphibians									
Acris crepitans (Baird)				1					
Anaxyrus americanus (Holbrook)				3	2	2		1	
Anaxyrus fowleri (Hinckley)		7		1	3		1	10	
Hyla chrysoscelis (Cope)				1			2	2	
Lithobates catesbeianus (Shaw)	1							1	
Lithobates clamitans (Rafinesque)	1			2			1	3	
Lithobates palustris (LeConte)		2				1		1	
Lithobates sylvaticus (LeConte)					1			1	
Pseudacris crucifer (Wied-Neuwied)								2	
Eurycea bislineata (Green)				2		11			
Notophthalmus viridescens (Rafinesque)								12	
Reptiles									
Chelydra serpentina (Linnaeus)			1					2	
Chrysemys picta (Schneider)	7							3	
Pseudemys rubriventris (LeConte)								1	
Terrapene carolina (Linnaeus)				1					1M
Plestiodon fasciatus (Linnaeus)		4		3	1				
Plestiodon laticeps (Schneider)		1			1				
Agkistrodon contortrix (P. de Beauv.)		3						1	
Carphophis amoenus (Say)								2	
Diadophis punctatus (Linnaeus)		1		1	1				
Heterodon platirhinos (Latreille)									1W
Nerodia sipedon (Linnaeus)	1							1	
Opheodrys aestivus (Linnaeus)		1							
Pantherophis alleghaniensis (Holbrook)				1					
Regina septemvittata (Say)									1L
Storeria dekayi (Holbrook)	2	1		1					
Thamnophis sirtalis (Linnaeus)				2					
Totals	12	20	1	19	9	14	4	43	3

* Miscellaneous observations: M= MacArthur Blvd. on road; W = in canal at north end of Widewater canal; L = sidewalk of museum at Lock 20.

Annotated Checklist of Species Observed at the 2006 Potomac Gorge BioBlitz

Class Amphibia

Order Anura
Family Bufonidae

Anaxyrus americanus (Holbrook) (Eastern American Toad) - [sites 4 (1 male, 1 female, 1 juvenile), 5 (2 females), 6 (2 adults), 8 (1)].

Anaxyrus fowleri (Hinckley) (Fowler's Toad) – [sites 2 (5 juveniles, 1 metamorph), 4 (1 dead), 5 (1 female, 2 juveniles), 7 (1 female), 8 (10 adults)]. The one adult female toad found at the entrance of Olmsted Island had a hind leg stripped to the bone. A total of ten adult toads were found foraging in the woods of Bear Island.

Family Hylidae

Acris crepitans (Baird) (Eastern Cricket Frog) – [site 4 (1 calling male)].

Hyla chrysoscelis (Cope) (Cope's Gray Treefrog) – [sites 4 (1 calling male), 7 (2 calling males), 8 (2 males, including 1 calling].

Pseudacris crucifer (Wied-Neuwied) (Spring Peeper) – [site 8 (2 metamorphs)].

Family Ranidae

Lithobates catesbeianus (Shaw) (American Bullfrog) – [sites 1 (1 adult), 8 (1 tadpole)]. On Bear Island, where *Batrochytrium dendrobatidis* has been found, no adults or other age class frogs were captured. This fungal infection, which affects keratinized skin, does not affect tadpoles (Carey et al., 2003).

Lithobates clamitans (Rafinesque) (Green Frog)– [sites 1 (1 male), 4 (1 juvenile), 7 (1 male), 8 (3 adults)]. Capture sites included a woodland vernal pool, a pond, and the cattail margin of another pond.

Lithobates palustris (LeConte) (Pickerel Frog) – [sites 2 (2 adults), 6 (1 adult), 8 (1 young adult)].

Lithobates sylvaticus (LeConte) (Wood Frog) – [sites 5 (1 adult), 8 (1 metamorph)].

Order Caudata
Family Plethodontidae

Eurycea bislineata (Green) (Northern Two-lined Salamander) – [sites 4 (2 adults), 6 (13 adults)].

Family Salamandridae

Notophthalmus viridescens (Rafinesque) (Red-spotted Newt) – [site 8 (12 adults)]. These animals were found by dipnetting in woodland ponds on Bear Island.

Class Reptilia

Order Testudines
Family Chelydridae

Chelydra serpentina (Linnaeus) (Snapping Turtle) – [sites 3 (1 adult), 8 (1 adult, 1 juvenile)]. One Snapping Turtle was captured in a baited hoop turtle trap set in the Potomac River. Numerous leeches were found attached to its skin. A fishhook lodged on a front foreleg was removed with pliers. A large adult Snapping Turtle was observed swimming in the Potomac River at Bear Island and a juvenile was dipnetted in a pond on the island.

Family Emydidae

Chrysemys picta (Schneider) (Painted Turtle) – [sites 1 (5 males, 2 females), 8 (3 adults)]. Painted Turtles were captured in Clay Pond using turtle traps, while those on Bear Island were observed swimming in ponds and the canal.

Pseudemys rubriventris (LeConte) (Northern Red-bellied Cooter) – [site 8(1)]. One juvenile was dipnetted in the canal bordering Bear Island. Algae collected from the shell of this turtle were submitted to the algae team, which identified the species as *Basicladia chelonum* (Collins) Hoffman.

Terrapene carolina (Linnaeus) (Box Turtle) – [site 4 (1 male)]. A male Box Turtle was found foraging in the woods at site 4. A female Box Turtle that was found crossing MacArthur Boulevard was removed the road.

Order Squamata
Family Scincidae

Plestiodon fasciatus (Linnaeus) (Five-lined Skink) – [sites 2 (3), 4 (2 females, 1 juvenile), 5 (1)]. Six Five-lined Skinks were collected during the survey period. They were found on downed trees, debris piles, and the rocky ruins of an old house. The juvenile skink was found in an old canal lock and was parasitized by mites and one tick. Another skink that was on a tree was also infested with ticks and mites.

Plestiodon laticeps (Schneider) (Broad-headed Skink) – [sites 2 (1 male), 5 (1 male)]. One skink was found on an old log and another mite-infested individual was captured on a woodpile.

Suborder Serpentes
Family Colubridae

Carphophis amoenus (Say) (Eastern Worm Snake) – [site 8 (2)]. Two adult worm snakes were found under logs near a pond on Bear Island.

Diadophis punctatus (Linnaeus) (Ring-necked Snake) – [sites 2 (1), 4 (1 juvenile), 5 (1 adult)]. All three Ring-necked Snakes were found under cover objects (logs, landscaping timbers) at park headquarters.

Heterodon platirhinos (Latreille) (Eastern Hog-nosed Snake). One melanistic adult Eastern Hog-nosed Snake was reported by another survey group, which found it swimming along the rocks in the canal at the north end of Widewater in the Great Falls section of Maryland. Upon capture it went through the stereotypical sequence of hissing loudly and flattening its head.

Nerodia sipedon (Linnaeus) (Northern Water Snake) – [sites 1 (1 basking adult), 8 (1 juvenile)].

Opheodrys aestivus (Linnaeus) (Rough Green Snake) – [site 2 (1)]. One juvenile green snake was captured as it moved in grass in a wet seep along the trail.

Pantherophis alleghaniensis (Holbrook) (Eastern Rat Snake) – [site 4(1)]. One adult Eastern Rat Snake was captured on the road below the guardhouse adjacent to site 4.

Regina septemvittata (Say) (Queen Snake). One adult Queen Snake was found on the sidewalk of the museum at lock 20.

Storeria dekayi (Holbrook) (Brown Snake) – [sites 1 (2 adults), 2 (1 adult), 4 (1 juvenile)]. Three individuals were found under logs and the other was under a brush pile.

Thamnophis sirtalis (Linnaeus) (Garter Snake) – [site 4 (2 adults)]. Two adults were found under a brush pile and a stump, respectively.

Family Viperidae

Agkistrodon contortrix (Palisot de Beauvois) (Copperhead) (Fig. 15) – [sites 2 (3 adults), 8 (2 juveniles)]. One Copperhead was coiled in leaves in woods beside a main walking path, another was found under a log, and a third was discovered under a brush pile. One of these animals was missing a tail tip. A juvenile was found under a log in the woods.

A checklist of all species of amphibians and reptiles reported from the Potomac Gorge compared with the species encountered during the BioBlitz is presented in Table 23. Although fourteen species of salamanders are known for this area (Cohn, 2005), only two were observed during the BioBlitz.

Discussion. Hot and dry conditions just prior to and on the first day of the survey period may have contributed to the paucity of salamander species found.

The BioBlitz was punctuated by a thunderstorm followed by heavy rain showers on the evening of 24 June through the next morning (Fig. 16). Despite these heavy rains, none of the explosive breeding anurans (e.g., spadefoots) were seen or heard. Other species of amphibians, particularly spring-breeding anurans, had probably completed breeding and were unlikely to be found easily during a June survey.

Fig. 15. An adult copperhead (*Agkistrodon contortrix*) found during the Potomac Gorge BioBlitz. ©2006, Roy Sewall.

Table 23. Checklist of Amphibians and Reptiles of the Potomac Gorge[1].

	Abundance[2]	BioBlitz		Abundance[2]	BioBlitz
Frogs/toads					
Acris crepitans	A	X	*Kinosternon subrubrum*	C	
Anaxyrus americanus	C	X	*Pseudemys concinna*	U	
Anaxyrus fowleri	A	X	*Pseudemys rubriventris*	U	X
Hyla chrysoscelis	C	X	*Sternotherus odoratus*	C	
Lithobates catesbeianus	C	X	*Terrapene carolina*	A	X
Lithobates clamitans	A	X			
Lithobates palustris	C	X	Lizards		
Lithobates sphenocephalus	C		*Aspidoscelis sexlineata*	U	
Lithobates sylvaticus	C	X	*Plestiodon fasciatus*	C	X
Pseudacris crucifer	A	X	*Plestiodon laticeps*	U	X
Pseudacris feriarum	A		*Sceloporus undulatus*	C	
Scaphiopus holbrookii	R		*Scincella lateralis*	U	
Salamanders			Snakes		
Ambystoma jeffersonianum	R		*Agkistrodon contortrix*	C	X
Ambystoma maculatum	C		*Carphophis amoenus*	C	X
Ambystoma opacum	C		*Cemophora coccinea*	R	
Desmognathus fuscus	A		*Coluber constrictor*	C	
Eurycea bislineata	C	X	*Diadophis punctatus*	C	X
Eurycea guttolineata	R		*Heterodon platirhinos*	U	X
Eurycea longicauda	U		*Lampropeltis calligaster*	U	
Hemidactylium scutatum	U		*Lampropeltis getula*	U	
Notophthalmus viridescens	C	X	*Lampropeltis triangulum*	U	
Plethodon cinereus	C		*Nerodia sipedon*	A	X
Plethodon cylindraceus	U		*Opheodrys aestivus*	C	X
Pseudotriton montanus	U		*Pantherophis alleghaniensis*	C	X
Pseudotriton ruber	A		*Pantherophis guttatus*	R	
			Regina septemvittata	U	X
Turtles			*Storeria dekayi*	U	X
Chelydra serpentina	C	X	*Storeria occipitomaculata*	U	
Chrysemys picta	A	X	*Thamnophis sauritus*	U	
Clemmys guttata	C		*Thamnophis sirtalis*	C	X
Glyptemys insculpta	R		*Virginia valeriae*	U	

[1]Source: http://beta2.c-t-g.com/gorge/nature/fauna.html
[2]A = Abundant, C = Common, U = Uncommon, R = Rare.

Table 24. Survey effort per site by the amphibian and reptile team.

Survey Effort	Site 1	Site 2	Site 3	Site 4	Site 5	Site 6	Site 7	Site 8
Number of hoop net sets	4	-	3	-	-	-	-	-
Number of surveyors	16	16	-	15	16	18	18	14
Hours surveyed	1	1.45	-	1.15	1.2	0.5	0.5	3
Man hours of survey effort	16	23.2		17.25	19.2	9	9	42

Fig. 16. Heavy rains on Saturday night and Sunday brought torrential waters to the Potomac Gorge, but not enough to deter a bit of Sunday morning field work by the amphibian and reptile team.

The survey yielded 27 species and 125 individuals representing 11 species of amphibians (nine anurans and two salamanders) and 16 species of reptiles (four turtles, two lizards, and 10 snakes) (Table 22). None of these species has a rare global or state status and no new county records were documented.

The members of the amphibian and reptile team were Jason Gibson (team leader), Paul Sattler, Emily Cole, Pattie Crane, Janet Eastridge, Rosemary Frezza, John Kleopfer, Heather Labelle-Spillman, Chris Risch, David and Wesley Van Gelder, John, Amy, Cherise, and Jennifer White, and Eric Wright. A summary of survey effort per site is given in Table 24. The team contributed a combined total of nearly 136 hours, including field work, travel time, specimen identification, and report writing (Table 25).

Final Species Count

In spite of torrential rains that cut the 30-hour survey nearly in half, 140 scientists, naturalists, students, and volunteers in 18 teams still managed to find and identify 1,232 species. They contributed a total of 2,322 hours (Table 25) before, during, and after the event to collect, prepare, and identify thousands of specimens from mostly historically undersurveyed taxonomic groups from NPS lands in the Potomac Gorge.

Table 25. Survey effort and results of the 2006 Potomac Gorge BioBlitz held 23-25 June 2006 at GWMP and CHOH.

TAXONOMIC GROUP	SURVEY TEAM*	TOTAL HOURS	TOTAL SPECIES
Green algae	7	170	68
Slime molds, fungi	9	13	60
Mosses, liverworts	6	240	21
Botany	4	32	38
Flatworms	1	13	4
Land snails, mussels	8	70	37
Isopods, amphipods	2	24	6
Crayfishes, copepods	8	No data	24
Spiders and kin	7	136	45
Dragonflies, damselflies	18	267	46
Mayflies, stoneflies, caddisflies, neuropterans	4	104	58
True bugs	2	46	55
Beetles	8	361	302
Scorpionflies	2	30	1
Flies	18	332	190
Moths, butterflies	15	230	185
Ants, bees	9	88	65
Amphibians, reptiles	16	136	27
TOTALS	**140****	**2322**	**1232**

*Number of surveyors and identifiers per team.
**Four surveyors served on two teams and are not counted twice.

DISCUSSION

Results and Significant Finds

Despite inclement weather on the evening of 24 June and all day 25 June, the 2006 Potomac Gorge BioBlitz generated records of 1,232 species, mostly insects and other invertebrates. This number might have reached 1,500 to 2,000 species if weather conditions had been more favorable to allow field survey efforts to continue throughout most of the 30-hour period, and if there had been additional invertebrate survey teams focused on other orders of insects.

The BioBlitz yielded many surprising and exciting new finds, including dozens of new species records for Maryland, Virginia, and the two national parks. For example, the green algae team alone generated 68 new species records for Great Falls Park (GWMP, VA) simply because this group of organisms had never been documented in the Potomac Gorge.

The most significant collections of historically known species of plants were of wavy grass *Deschampsia flexuosa* (Linnaeus) Trin., and sweet birch, *Betula lenta* Linnaeus, which were last documented near Great Falls, VA, in 1879 and 1884, respectively. *Deschampsia flexuosa* is not known elsewhere in the Potomac Gorge, whereas *B. lenta* is rare in the upper part of the Gorge, upstream of Bullneck Run. Both species were collected on a steep, rocky, river-fronting bluff just upstream from the mouth of Difficult Run. Another interesting collection was that of black maple, *Acer nigrum* Michx., which is primarily distributed in limestone areas of the Central Appalachian Ridge and Valley province. This tree is found only occasionally east of the mountains in the Potomac River Valley, also occurring upstream at Balls Bluff Regional Park (Loudoun Co.) and Riverbend Park (Fairfax Co.). Also noteworthy is *Elymus macgregorii*, a recently described species of wildrye (Brooks & Campbell, 2000), which flowers and fruits 4-6 weeks earlier than its congeners riverbank wildrye (*E. riparius* Wiegand), hairy wildrye (*E. villosus* Muhl. ex Willd.), and Virginia wildrye (*E. virginicus* Linnaeus). Long thought to be a form of the latter, *E. macgregorii* is now considered distinct and known to be abundant in many forested floodplains of the Gorge.

Two rare snails, *Punctum smithi* Morrison and the slender walker snail, *Pomatiopsis lapidaria* Say, were found. Two less desirable finds included the exotic virile crayfish (*Orconectes virilis*), an aggressive competitor with native crayfish, as well as *Arion hortensis* (Ferussaci), a non-native European slug.

The dragonfly and damselfly survey produced two new species records for the Gorge, the lilypad forktail (*Ischnura kellicotti* Williamson) and Needhams's skimmer (*Libellula needhami* Wesfall). In addition, the double-striped bluet (*Enallagma basidens* Calvert) and *Ischnura kellicotti* have ranges that are expanding quickly and have moved into the region just in the past few decades.

Nine new state records were recorded by the true bug team for both Maryland and Virginia. Four species, three Miridae and one Tingidae, represent new state records for Maryland. Five species, one Anthocoridae and four Miridae, represent new state records for Virginia. The exotic anthocorid *Amphiareus obscuriceps* (Poppius) represents a new Western Hemisphere record and is being reported from a number of states (Henry et al., 2008).

The beetle team collected 19 new state records for Virginia including *Acalles carinatus* LeConte, *Acoptus suturalis* LeConte, *Anthonomous suturalis* LeConte, *Cophes obtensus* (Herbst), *Cryptorhynchus tristis* LeConte, *Listronotus humilis* Gyllenhal (Curculionidae); *Aeolus scutellatus* (Schaeffer), *Neopristilophus aethiops* (Herbst) (Elateridae); *Dirrhagofarsus lewisi* (Fleutiaux), *Stethon pectorosus* LeConte (Eucnemidae); *Melanophthalma distinguenda* Comolli (Latridiidae); *Orchesia ovata* Laliberte (Melandryidae); *Glipa hilaris* (Say), *Mordellistena ornata* (Melsheimer), *Pseudotolida lutea* (Melsheimer) (Mordellidae); *Cathartosilvanus imbellis* (LeConte) (Silvanidae); *Strongylium crenatum* Malkin, *Uloma mentalis* Horn (Tenebrionidae); and *Eucicontes marginalis* (Melsheimer) (Zopheridae). None of these represents a significant range extension since nearly all were recorded previously in Maryland and Washington, DC.

The fly team collected a specimen of *Scatophila carinata* Sturtevant, a species that had not been recorded east of Iowa. They also collected five species that are apparently new to science. Although some of these species had been collected in the region previously, at least one of them, *Hydrellia* sp., is known primarily from specimens collected during the BioBlitz.

The bee *Anthidiellum notatum* (Latreille) appears to be a new record for Virginia (Ascher, unpublished). Both this species and *Heriades carinatus* Cresson are uncommon and characteristic of dry, open habitats. Additional records of uncommon bee species are expected in the region with more intensive sampling throughout the year, particularly in the open rocky areas along the river.

Lessons Learned

Logistics. BioBlitzes require extensive planning and advanced preparation to run smoothly. Because the Potomac Gorge BioBlitz took place in a major metropolitan region within two separate national parks, it required a significant amount of time and effort to plan and execute. The technical coordinator of the Potomac Gorge BioBlitz and the staffs of TNC and NPS worked together for more than a year prior to the event to facilitate access to park lands, apply for scientific collecting permits for two national parks and one state, arrange housing for 140 volunteer researchers during the event that included adequate facilities for the initial preparation and identification of specimens, feed 180 volunteers (including support staff) for two days, and organize the repatriation of voucher specimens to the NPS. This last task required more than 20 months after the BioBlitz to accession specimens and finalize data entry, including the full-time efforts of an NPS intern for six months.

Another practical lesson learned is the importance of advanced planning for a rain or shine event. Weather conditions can affect the research effort by limiting the survey period, making specimens more difficult to find and collect, and significantly reducing the amount of data gathered. Inclement weather also affects logistical planning, such as housing for researchers, as well as outdoor food preparation and educational programs. Fortunately for the participants of the Potomac Gorge BioBlitz, the facilities at Glen Echo Park, Maryland, were selected with bad weather in mind.

Technical issues. Several team leaders noted the limitations of the BioBlitz format itself. It has been long observed that these events are only seasonal "snapshots" of a particular habitat or region and can never be a meaningful substitute for carefully planned, long-term field studies. Nevertheless, for NPS lands lacking the basic data concerning their biota, the sudden infusion of species lists, even with minimal ecological data, can help to identify species in need of immediate further study or conservation management.

Furthermore, the format of most BioBlitzes, including the Potomac Gorge BioBlitz, is intended to serve two purposes simultaneously, science and public education. BioBlitzes provide an important opportunity for students and citizen scientists to meet researchers and work with them in the field to learn basic collection, preparation, and identification techniques. Many scientists who participated in the Potomac Gorge BioBlitz relished the opportunity to meet with and share their expertise with the public, especially students (Fig. 17). However, enthusiastic and well-meaning volunteers have a broad range of knowledge and experience and often require considerable training and supervision by scientists. Consequently, some team leaders and other scientists were unable to dedicate as much of their time as desired during the event to their field surveys and species identifications.

Another challenge that is unique to all BioBlitzes held on NPS lands, including the Potomac Gorge BioBlitz, involves voucher disposition. Bona fide researchers associated with universities and museums have no qualms whatsoever in depositing a synoptic collection of voucher specimens with NPS facilities. However, insistence by NPS-permitting authorities that ALL vouchers, including type specimens, be deposited in NPS collections remains a serious impediment to recruiting specialists and their institutions to participate in such events. The arguments on each side of the issue are well known to NPS staff, museum researchers, and other scientists, and will not be repeated here. Until the NPS and the major research institutions in the United States reach a mutually acceptable agreement, both the NPS and science will continue to suffer due to the lack of researchers willing to conduct research of any kind on NPS lands.

Fig. 17. Many scientists participating in the Potomac Gorge BioBlitz relished the opportunity to meet with and share their expertise with the public, especially students. ©2006, Mark Godfrey.

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The breadth and depth of data gathered during any BioBlitz is dependent upon the dedication of scientists who share their expertise, enthusiasm, and limited field time to launch an intensive biological survey. They are charged with recruiting and training volunteers with a wide range of field and taxonomic experience, choosing and implementing select field methods that will reveal the greatest diversity of their target organisms, and overseeing the gathering and recording of data.

The team leaders of the 2006 Potomac Gorge BioBlitz were the backbone of the event and brought to bear a depth of taxonomic understanding and field experience that spanned four kingdoms. These talented and dedicated researchers were Barbara Abraham, Scott Bates, Lance Biechele, John Brown, Sam Droege, Arthur Evans, Daniel Feller, Gary Fleming, Oliver Flint, Jason Gibson, John Hall, Zachary Loughman, Joshua Jones, Wayne Mathis, Arnold Norden, Richard Orr, and DorothyBelle Poli.

Special thanks go to the volunteer surveyors and specialists who donated their time to observe, collect, sort, prepare, and identify species for the survey. Without their hard work the BioBlitz would have been neither as successful nor as meaningful. These dedicated people were Sarah Abboud, David Adamski, Michael Adkins, Michael Bean, Paul Bedell, Irina Brake, Chris Carr, Susan Carty, Nicole Cinta, Kathryn Ciulla, Ken Clayton, Emily Cole, Pattie Crane, Charlie and Linda Davis, Don and Mignon Davis, Christopher Van DeMoortel, Maureen Dougherty, Jesse Duff-Woodruff, Janet Eastridge, Jon Ellifritz, Cristol Fleming, James Forbes, Cristina Francois, Rosemary Frezza, Colin Funaro, Stephen Gaimari, Richard Gaines, Jon Gelhaus, Gerard Gomes, Blair Goodman, Graham Griffiths, Kim Harrell, Diane Holsinger, Stan Hopkins, Cathy and Angela Hutto, Beth Johnson, Lisa Kaltenberger, Hormuzd Katki, Diane Keefe, Alex Kim, Laura Kimpel, Daniel Kjar, John Kloepfer, Lloyd Knutson, Heather Labelle-Spillman, ZoAnn Lapinsky, Jon Lewis, Eric Lind, Steve Lingafelter, Kathy Loughman, Robert Lyon, Carolyn Marks, Stephen Marshall, Jonathan Mawdsley Deblyn Mead, Gregg Mendez, Donna Mitchell, Kurt Moser, Susan Muller, Peter Munroe, Stephanie Nelson, Kate Nisselson, Allen Norrbom, Aydan Orstan, Gary Ouellette, John Pascarella, Megan Paustian, Tim Pearce, Becca Phillips, Michael and Anne Pogue, Janet Reid, Susanna Rhodes, Michael Rhodin, Terry Richards, Chris Risch, Steve, Tim, and Ben Roble, William Roody, Betty Rosson, Justin Runyon, Paul Sattler, Aubrey Scarbrough, Jennifer Selfridge, Charles and Karen Sheffield, Eric Soderholm, Bob and Joe Solem, Matthew Southy, Warren Steiner, Jil Swearingen, Ester Sztein, Christian and Betty Thompson, Ashley and Kate Traut, Mary Travaglini, Craig Tufts, June Tveekrem, David and Wesley Van Gelder, Kimberly Vann, Tabitha Viner, Christopher Vopal, Ralph Webb, Terry Wheeler, John, Amy, Cherise, and Jennifer White, Hollis Williams, Chris Wirth, Michael Wittig, Norm Woodley, Eric Wright, Tadeusz Zatwarnicki, and David Ziolkowski.

The staff of the MD/DC Chapter of The Nature Conservancy (TNC) went beyond the call of duty to make the event both a scientific and educational success. Logistical Czarina Mary "The Wedding Planner" Travaglini and the rest of the Conservancy's cadre of dedicated staff and volunteers helped to turn several rooms of an old amusement park into a highly functional base camp with comfortable and spacious quarters for working and sleeping. They ensured that the BioBlitz participants lacked nothing and provided plenty of cold drinks, fruit, snacks, and hearty meals for dining in or packing out into the field. Mary's hard work, meticulous planning, and constant good cheer helped to keep everyone's spirits high in spite of the oppressive heat and torrential downpours. And she helped to keep the final report on track throughout much of 2007 and 2008.

TNC media relations specialist David Dadurka did an impressive job of disseminating information about the BioBlitz. It was his enthusiasm for the project and media savvy that resulted in the great coverage for the event. BioBlitz educational coordinator Amy Hastie marshaled an impressive array of exhibitors and environmental educators to create an engaging public education program that brought home the diversity of the Potomac Gorge to all of the BioBlitz visitors. TNC writer Danny White joined some of the field survey teams and documented his experience with a "Postcard from the Field," bringing the BioBlitz experience to a broader group of world wide web observers than could have participated in the event. TNC photographer Mark Godfrey helped document some of the team's exploits and findings, as well as the overall dynamics at the Glen Echo Park base camp.

The Glen Echo Park Partnership for Arts and Culture, including Mary Boeckman, Paul Squire, and Dwain Winters, not only provided tremendous logistical support for the base camp, but also greatly facilitated operations of the public education tent.

Photographers Mark Godfrey and Roy Sewall generously allowed the use of their wonderful photos to illustrate portions of this report. Their images of habitats, organisms, people, and the interactions thereof help to capture and preserve the very essence of the BioBlitz.

Journalists Elizabeth Williamson (*Washington Post*), Dan Ferber (*Nature Conservancy* magazine), and Susan Milius (*Science News*) joined several of the survey teams in the field and later in the base camp to better understand the phenomena of the Potomac Gorge BioBlitz. They conducted numerous interviews with team leaders and volunteer surveyors to learn what motivated a wonderfully eclectic group of people to participate in such an event. These journalists ably articulated the sights, sounds, smells, and motivations that drive such an event to their respective readerships. Their insights and efforts to accurately portray the event to the public were much appreciated by all of the participants.

A core of committed National Park Service staff representing the two Potomac Gorge Parks (GWMP, VA and CHOH, MD) and the National Capital Region Center for Urban Ecology worked behind the scenes and contributed their vast collective knowledge of the region to support the BioBlitz planning effort. Their assistance ranged from providing information on previously documented flora and fauna in the parks, aligning the activities of the BioBlitz with NPS policies and procedures, developing data management systems to track the survey results, and offering critical information on park safety and accessibility.

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Nature educators and entertainers Martin and Chris Kratt travelled from Vermont to emcee the BioBlitz closing ceremony. These well-known television nature program personalities shared their love of all things wild with the BioBlitz volunteers and members of the public who braved the day's inclement weather to participate in the closing ceremony and learn the preliminary species count.

Special thanks are also due to Anna Santos, National Park Service intern, for accessioning thousands of vouchers collected during the BioBlitz. She was in the unique position of having the vouchers, data sheets, and final report in her possession simultaneously and had the onerous task of resolving a myriad of discrepancies. The accuracy of this report is due in large part to her meticulous efforts and dedication.

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